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NEUROPHYSIOLOGICAL CORRELATES TO REMOTE VIEWING (U)

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I INTRODUCTION (U)

A. (U) History of Central Nervous System Correlates to Psychoenergetic Functioning

(U) Evidence from several laboratories has indicated the possible existence of an as-yet--unidentified channel wherein information is coupled from remote electromagnetic stimuli to the human nervous system. Usually the coupling has been indicated by physiological responses, even though overt responses such as verbalizations or key presses have provided no evidence for information transfer. Physiological measures have included a plethysmographic response*[1] and electroencephalogram (EEG) activity.[2,3] Kamiya, Lindsley, Pribram, Silverman, Walter, and others have suggested that the whole range of EEG activity, including evoked potentials, spontaneous EEG activity, and the contingent negative variation (CNV) might be sensitive indicators of responses to remote stimuli.[4]

(U) During fiscal years 1973 and 1974, SRI International investigated a viewer's central nervous system (CNS) response to a remote light stimulus. In these experiments, the viewer was asked to focus attention on a remote flashing (16-hertz [Hz]) light. Control periods (no light flashing) were randomly mixed with effort periods (light flashing). The viewer was further asked to register when he† perceived the flashing light by pressing a button.

(U) During the pilot phase conducted at SRI,[5] the viewer showed a significant decrease in alpha production when the remote light was flashing compared with when the light was off. His button presses were random, however, indicating he was not cognitively aware of the flashing light. Two replications of this effort were conducted at Langley Porter Neuropsychiatric Institute in San Francisco by Drs. David Galin and Robert Ornstein.[6] In the first of two experiments the same viewer continued to show a significant decrease of alpha production under the remote flashing light condition only. In a second experiment conducted 9 months later, however, the same viewer demonstrated a significant increase of occipital alpha production.

(U) With the advent of more sensitive CNS monitoring equipment, and with an additional 15 years of remote viewing experience, SRI conducted a series of experiments to explore possible

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* (U) References may be found at the end of this report.

† (U) To keep the identity of the viewers confidential, we use the pronouns *he* and *his* throughout this report, regardless of the viewer's gender.

(U)
correlations between CNS activity and remote stimuli.* These experiments are the subject of this report.

B. (U) Background

(U) Magnetoencephalography (MEG) is a noninvasive technique used to observe and locate, in three-dimensional space, magnetic fields produced by neuronal electric currents in the cortex of the brain. An MEG device (sometimes referred to by a noun, MEG) can determine the spatial distributions of specific neurons participating in a given activity and their patterns of activity over time. This technology has been used in research ranging from evaluating how normal brains process information to diagnosing clinical conditions such as epilepsy and dementias.[7]

(U) Neurons that participate in a given functional activity communicate between themselves and ultimately other parts of the body by electrical signals. These signals are produced by a flow of sodium, chlorine, potassium, and calcium ions traveling from the dendrites down the axon and to the synaptic buttons of each neuron. Each neuron may act as a magnetic dipole that produces a magnetic field.

(U) The sensing device of the MEG is a cryogenic superconducting quantum interference device (SQUID) coupled with a gradiometer. SQUIDs currently being used are cooled by liquid helium. At a few degrees above absolute zero an electrical current can flow through a superconductor with no applied voltage. The superconductor is divided into two pieces connected together with a thin layer of electrical insulation between them. Some electrons can pass through this insulation. A weak magnetic field, however, interferes with the flow of electrons through this barrier. The amount of interference indicates the strength of the magnetic field.

(U) The neuronal magnetic fields in the human brain are only about 10^{-13} tesla, while the earth's magnetic field is 10^{-4} tesla and normal urban noise is about 10^{-7} tesla. Care must be taken, therefore, that the signal-to-noise ratio is favorable. This has been taken into consideration by the manufacturer of MEG equipment (BTi of San Diego), who has designed highly shielded sensors that use a second-order coupled gradiometer to reduce the environmental noise by about 10^6. The use of an aluminum and μ-metal magnetically shielded

*(U) This report constitutes the deliverable for Objective D, Task 1.

(U)

room can reduce the signal-to-noise ratio further by a factor of 10^3. If used together these two precautionary measures can reduce the ambient noise by a factor of about 10^9.

(U) Since the MEG responds best to neuronal currents that are parallel to the skull (i.e., currents producing magnetic fields oriented tangentially to the skull), neuronal currents perpendicular to the skull may be missed. In reality, however, few neuronal electrical currents are exactly perpendicular to the skull, so some tangential component is almost always available to the SQUID.

(U) Looking at a single or closely packed group of neurons can be a slow and tedious process. Due to technological restraints, a maximum of seven sensors can be used simultaneously to gather MEG measurements. Sensors on a seven-channel MEG are located on a 2-cm equilateral triangular grid forming the center and vertices of a regular hexagon. A subject wears a spandex cap with grid marks lined up with the nasion, inion, and ear lobes of the subject to serve as a head-centered coordinate system. To identify the location of a neuronal-equivalent dipole, many measurements have to be taken. Isocontour maps of field strength are used to represent the amplitude and polarity distribution of the magnetic fields. A least-squares procedure is applied to the observed fields to estimate the location of neuronal sources and orientation of the magnetic current.[8] The estimated location of the neuronal source can then be identified with an MRI (magnetic resonance image) scan of the head. Developments in technology may soon allow for enough channels to cover the whole head at once, thereby reducing data collection time and increasing precision.

(U) In its current form, the MEG must be suspended in an inverted position above the subject. This technology is based on a cryogenic SQUID operating in liquid helium. Because the Dewar flask cannot exceed a 45-degree angle, subjects must lie prone beneath the apparatus. MEG sensors are not attached to the head, but are only lowered into position over the skull; the subject cannot move his or her head during monitoring without disturbing the measurement. For these two reasons, MEG equipment is not suited for long-term monitoring of a subject. These problems may be solved shortly as new technology, such as high-temperature SQUIDs, develops.

(U) A response from the MEG is a complex wave form consisting of a series of negative and positive peaks or components. Specific components of this wave form can be correlated with perceptual and cognitive processes. The most commonly observed response to a visual or auditory stimulus, for example, is a large component occurring approximately 100 milliseconds(ms) after the onset of the stimulus. One hundred milliseconds appears to be the

(U)
average latency period between stimulus and the first correlated neuronal activation in the brain.[9]

(U) The earlier technology of EEGs measures electric potential, or event-related potentials (ERPs) produced by the electrical activity of the brain. An MEG measures the magnetic fields, or event-related fields (ERFs) produced by the electrical activity of specific groups of active neurons in the cortex. An EEG and an MEG, therefore, reveal different aspects of the electrical activity of the brain and are often used as complementary technologies. In some areas, however, the MEG technique has definite advantages over EEG techniques:

(1) ERPs taken from the scalp provide little information regarding the precise three-dimensional distribution of the neuronal sites producing the electrical activity. Brain tissues of unknown electrical conductivity and thickness, individual variations in skull thickness and geometry, and proximity to openings in the skull, all make obtaining such detailed information difficult. The same is not true when using an MEG: Neuronal magnetic fields can travel through brain tissues without being significantly altered; this results in high spatial resolution of the neuronal activity.

(2) EEG procedures are occasionally costly and modestly to highly invasive: EEG electrodes must be attached directly to the skull or to the brain of the subject, MEG detectors are extracranial and are simply lowered into position against the skull.

(3) There is much controversy over the appropriate reference electrode in EEG work (a reference electrode is required with electric potential measurements, because only differences in electric potential are measured). There is no such problem with an MEG, since the measurement of magnetic fields is absolute.

II METHODS OF APPROACH (U)

A. (U) General Description

(U) Under the direction of Dr. Edward Flynn, the Neuromagnetism Laboratory at Los Alamos National Laboratory has been using a seven-sensor MEG in conjunction with a shielded room to conduct research on neuroanatomy and physiology. Recently, their experiments have looked at (1) visual-evoked responses to sinusoidal gratings presented to the central or right visual field[10] and, (2) the effects on ERFs of selective attention.[11]

(U) We intended to investigate neuronal magnetic activity in the brain cortex that might occur in response to a remote stimulus. Our overall hypothesis was that we can detect EERFs that correspond to a remote and isolated stimulus. To test our hypothesis, we developed two protocols that are similar to the Los Alamos protocol. In fact, only minor changes to the Los Alamos protocol were necessary.

(U) The following definitions may be helpful in reading this report:

- Psi—Putative extrasensorimotor communication with the environment.
- Viewer—An individual who attempts extrasensorimotor communication with the environment (e.g., the perception of remote stimuli).
- Remote Stimuli (RS)—Stimuli occurring outside the viewer's range of known sensory channels.
- Direct Stimuli (DS)—Stimuli occurring within the viewer's range of known sensory channels.
- Sender—An individual who, while receiving direct stimuli, acts as a putative transmitter to a remote individual (i.e., viewer) who is attempting to receive the same information via psi.

B. (U) Protocols

(U) A difficulty in developing a protocol is determining the initial position of the detector array. We chose to select the location that optimizes the response to a direct stimulus. Inherent in this choice is an assumption that may not be valid. Neurons participating in a reaction to a remote stimulus are the same as those that react to a direct stimulus.

(U) The first protocol is based on an experiment in Budapest, Hungary, by Zolton Vassy.[12] The Vassy protocol examines whether a viewer can respond to remote stimuli. In this case, the remote stimuli are analogous to conditioned stimuli in classical conditioning experiments, and the direct stimuli are analogous to unconditioned stimuli. A sender is isolated in a separate room while a viewer is monitored by an MEG in a remote magnetically shielded room. A sender is first shown a visual stimulus consisting of a sinusoidal grating light flash (remote stimulus). After approximately 500 ms a viewer is shown an identical stimulus (direct stimulus). This procedure, or trial, is repeated 50 times at random time intervals to form one run. The multiple trials are used in data averaging.

(U) Following is the schedule for a single trial:

- Time = 0: A computer-generated trigger starts the monitoring of data (500 ms of prestimulus data).
- Time = 500 ms: 100 ms of a remote stimulus is presented to the sender only.
- Time = 600 ms: 440 ms of poststimulus data is recorded.
- Time = 1040 ms: 100 ms of a direct stimulus is presented to only the viewer.
- Time = 1140 ms: 560 ms of poststimulus data is recorded.
- Time = 1700 ms: Data collection ends.

(U) If the CNS reacts to a remote stimulus, we expect to see both a large component in response to the direct stimulus and a smaller but similar response to the remote stimulus with approximately the same response latency. Figure 1 is an idealized illustration of expected results.

(U) The second protocol is called the psi protocol. It is a conceptual replication of an earlier experiment conducted in 1975 using EEG techniques.[6] As in the Vassy protocol, a sender is isolated in a room while a viewer is monitored by an MEG in a remote shielded room. The sender is presented with a minimum of 9 and a maximum of 15 visual stimuli—sinusoidal grating light flashes—occurring at random intervals within a 120-second period, the length of one trial. Ten trials equal one run. The viewer is never presented with direct stimuli, but is instructed to press a fiber-optic-coupled button when he perceives stimuli. Each button press is marked in the data record. (Button pressing was retained in this protocol as part of the conceptual replication.) In later runs, an equivalent number of pseudostimuli (i.e., random time markers with no concomitant stimuli) are added as a within-run control.

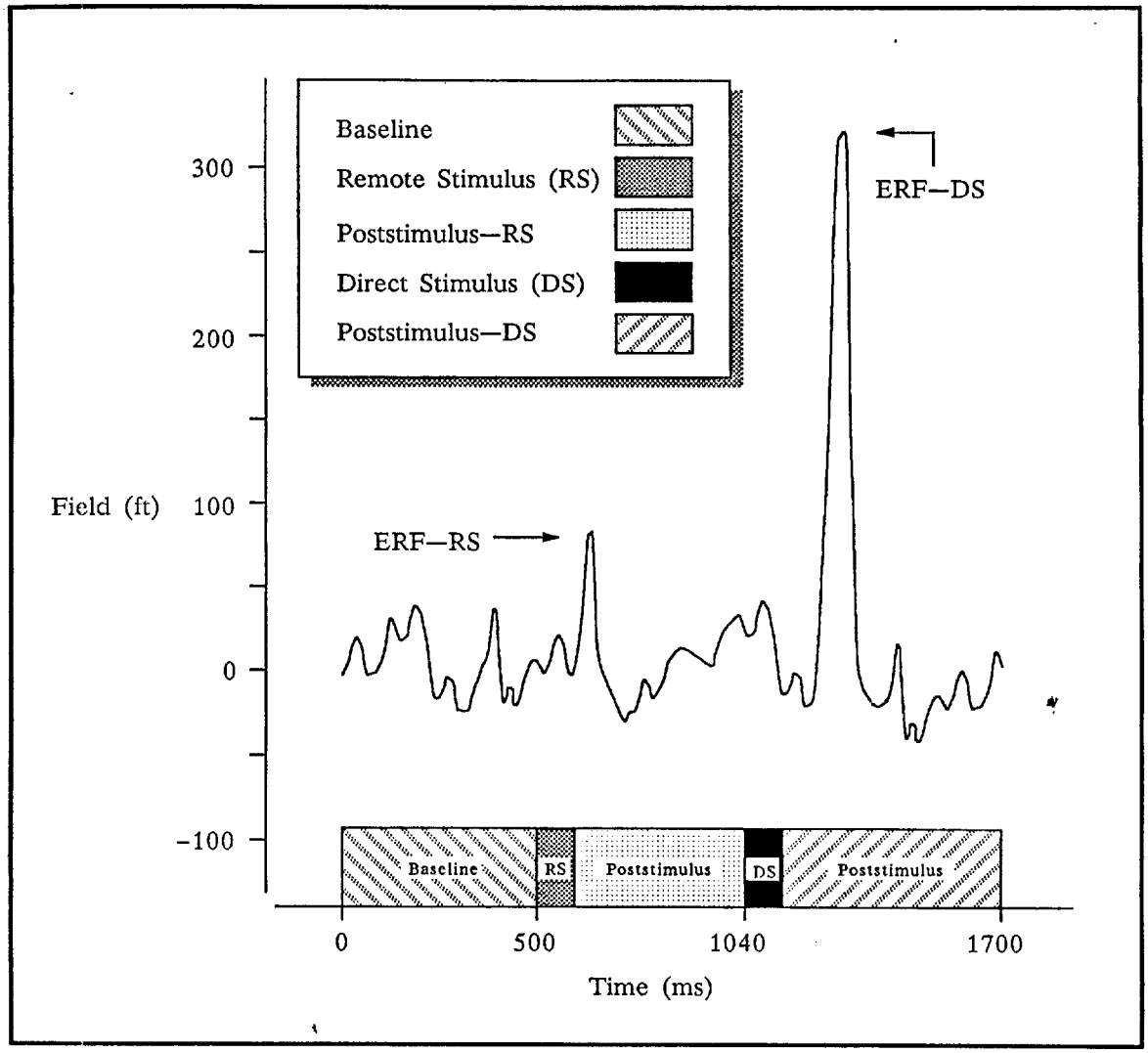

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FIGURE 1 (U) VASSY PROTOCOL—SINGLE TRIAL

(U) Following is the schedule for a single trial:

- Time = 0: A computer-generated trigger starts the monitoring of data. Data are collected the entire 120 seconds.
- Time > 120 seconds: The viewer does not leave the table, but has a break for about 2 to 5 minutes between runs. This break generally consists of one of the experimenters entering the shielded room to engage the viewer in trivial conversation.

(U) Postsession background control runs are conducted exactly the same as normal runs except neither a viewer nor sender is present.

(U) If our initial assumption is true, and if the earlier results are replicated, we expect to see a fast response to the remote stimuli, as well as a change in primary alpha production. Figure 2 is an idealized illustration of these expected results.

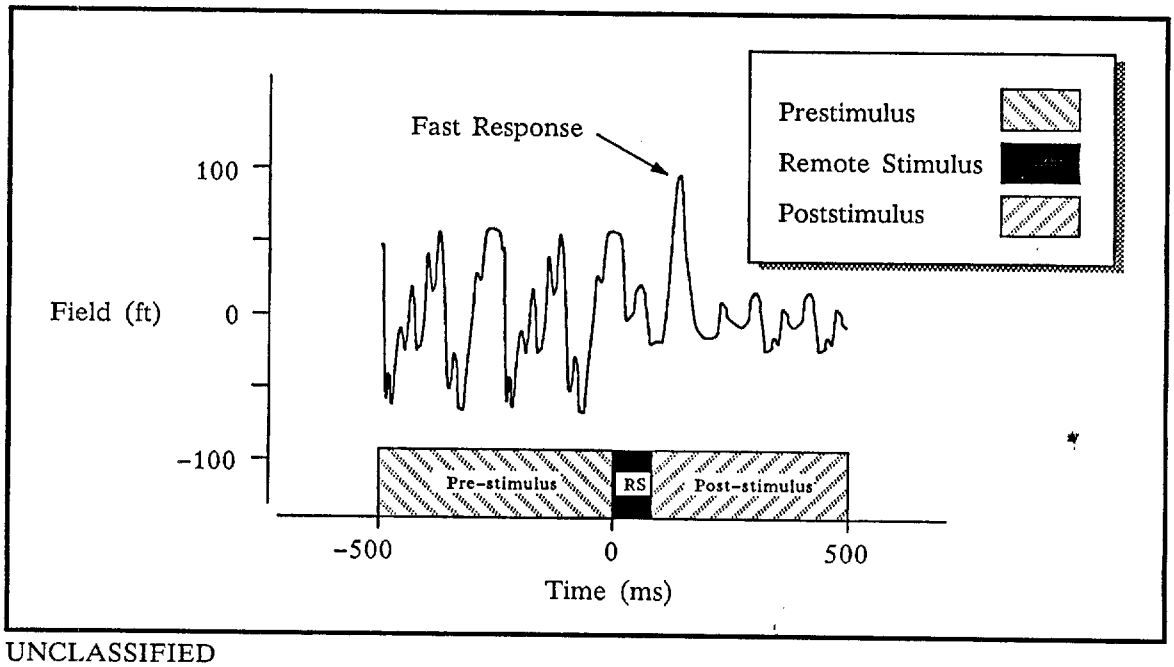

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FIGURE 2 (U) PSI PROTOCOL—SINGLE TRIAL

(U) For both protocols, the trial randomization procedure involves a "dead time" after the onset of a stimulus. During this time no further stimuli are allowed. Following this is a preset time interval during which the next stimulus occurs. The timing of that stimulus is randomly assigned within that interval.

(U) In each of the two protocols the visual stimuli are 2-cycle-per-degree (cpd) and 6-cpd sinusoidal gratings presented vertically and subtending 2 degrees in the left visual field. (Several trials of the Vassy protocol were attempted using auditory stimuli presented in the right ear, but the effort was abandoned when a viewer complained that the direct stimulus disturbed his concentration on the remote stimulus.)

(U) Before each experimental session, we perform a background run to check the ambient noise and operating condition of the MEG equipment. A background run consists of from 10 to 100 trials of the protocol to be used. All experimental equipment is in place and operating as if in an actual experiment, except no viewer or sender is present.

(U) Once the viewer is fitted with the spandex cap with the grid marks lined up with his inion, nasion, and ear lobes, he is placed as comfortably as possible on an observation table beneath the MEG. The viewer must lie face down and look though a hole in the table. Via a system of mirrors beneath the table, the viewer sees stimuli that are displayed by a projector located outside the entrance to the shielded room. The sensors of the MEG are lowered from above to touch the head over the right occipital lobe. Meanwhile, a sender isolated in a room down a corridor from the shielded room, is seated in a chair facing a television monitor. To present the stimuli in the lower left visual field, the viewer and the sender are both instructed to fix their gaze on dots attached to their respective display screens. The stimuli then subtend 2 degrees of visual field.

(U) Next, a calibration is done to find the optimum placement of the MEG sensors. By moving the MEG, the largest response to the direct stimulus is sought. The sensor locations are then marked on an acetate transparency having grid marks identical to those on the spandex cap. This allows sensors to be placed near the same locations in later sessions.

(U) The experiment is conducted and monitored from a computer control room located across a corridor from both the shielded room and the sender's room. Communication into the shielded room is accomplished via an intercom system.

C. (U) Analysis—General Considerations

(U) As indicated in Section I, the MEG can locate neuronal sources to within a few cubic millimeters. Unfortunately, this high spatial resolution means that the MEG is extremely sensitive to detector array location. Moving the array 0.5 cm can change the observed data in significant ways. It is imperative, therefore, to search each detector for candidate peaks individually.

(U) A candidate peak must be observed systematically before it can be considered a response to a remote stimulus. For example, a given viewer's candidate peak must be observed during different MEG sessions at the same time relative to the remote stimulus. Ideally, the peak should exhibit a self-consistent variation in magnitude across the seven data channels. Such variation might indicate a neuronal source that could be better observed by moving the detector array.

(U) If candidate peaks that are similar in timing relative to the remote stimulus are observed across viewers, then we can argue that viewers respond to remote stimuli. If peaks

(U)
identified during the baseline period (i.e., 0 to 500 ms) exhibit similar self-consistent timing, however, then the argument is weakened.

(U) The analysis of CNS activity has always been problematical. From a statistics point of view, the data fail to satisfy at least two underlying assumptions of the usual statistical methods (e.g., ANOVA and MANOVA). Most standard statistical tests require that all samples of the data be independent. Clearly this condition is not satisfied by CNS activity. MANOVA, which can be configured to remove this particular requirement (point-to-point), nonetheless assumes that the process under study is stationary; that is, whatever the statistical properties, they remain constant over time. In other words, the measured properties should not depend upon when the activity is sampled. Stationarity is required by all the standard tests. CNS activity does not meet this requirement.

(U) As a first attempt in analyzing the CNS activity, we adopted a simple Monte Carlo approach. Suppose a particular measure (e.g., variance, 8- to 12-Hz power) appears to change across a stimulus marker. There are three questions of interest:

(1) Is the prestimulus condition exceptional?

(2) Is the poststimulus condition exceptional?

(3) Is the ratio of pre- to poststimulus condition exceptional?

Because of the difficulties outlined above, these questions cannot be answered in an absolute manner; however, we can examine these issues from a relative perspective given the data sample at hand.

(U) Under the null hypothesis, the given data sample does not depend upon the set of stimuli. Thus, a measure across a stimulus marker can change only because of statistical fluctuations within the data sample. To determine if this is true, we adopted the Monte Carlo procedure outlined as follows:

(1) Generate N random examples of the measure in question within the data sample at hand. For example, if the measure is the variance of averaged (over M stimuli) data, then N is the number of sets of M randomly generated stimuli markers.

(2) For each pass $(1...N)$ compute the measure in question.

(3) Sort the N values of the measure. These values constitute the distribution of the measure in the given data sample.

(U)

(4) Compute the probability that the observed measure would be as large (or larger), given a repeated random sample of the data. Note that this p–value is *not* the probability that the measure is as large, given a different data sample.

The p–value derived by the technique can be considered only a crude indicator, since it depends upon N, and the optimum value of N depends upon the size of the data sample.

III RESULTS (U)

(U) Viewers 002, 007, 009, 372, 531, and 908 from SRI International, and viewers 262 and 734 from Los Alamos National Laboratory participated in the effort. Viewers 002, 009, and 372 were experienced while viewers 007, 262, 531, and 734 had not previously participated in remote viewing trials. As described in Section II, the output from the MEG consisted of seven channels of data recorded simultaneously from different physical locations. These data were stored either in average mode (i.e., signal averaging was accomplished in real time) or as single passes (i.e., the signal averaging was accomplished during later processing).

A. (U) Vassy Protocol

(U) Since there was no initial hypothesis (other than a possible response to remote stimuli), the following analyses are, by definition, post hoc. In the signal-averaged condition, the data from each viewer and each series were visually inspected for prominent peaks regardless of the data channel. Candidate peaks for a possible response to the remote stimuli were identified for later comparison. See Figure 1 for a schematic representation of a candidate peak.

(U) This particular post hoc approach is problematical. Because the data across viewers are especially ill behaved (statistically), it is difficult to estimate the degree to which the timing of candidate peaks is fortuitous.

As shown in Figure 3, the response (in channel 1) to direct stimuli for V002 exceeds 400 ft. The arrows in each channel mark a candidate peak for response to remote stimuli. This peak appears approximately 100 ms after the onset of the remote stimulus, and is most prevalent in channel 1. (The peak is the left-most component of a broader response.) This peak can be seen in channel 2, but is absent from channels 4, 5, and 6 and is sharply reduced in channel 3. This candidate peak, by itself, is not particularly compelling. Yet data from the next session, one day later, show a strong peak with the identical timing.

On that day, 23 August, the detector array was placed as close as possible to the location on the previous day. This new placement resulted in a sharply reduced response to the direct stimulus (see Figure 4) from that shown in Figure 3. In fact, all channels show a reduced response to the direct stimulus indicating that the detector array might have been moved away from the CNS site that was responding to the direct stimulus. The arrows indicate a peak in each channel that corresponds ($\pm$2 ms) to the peaks indicated in Figure 3. In all channels the

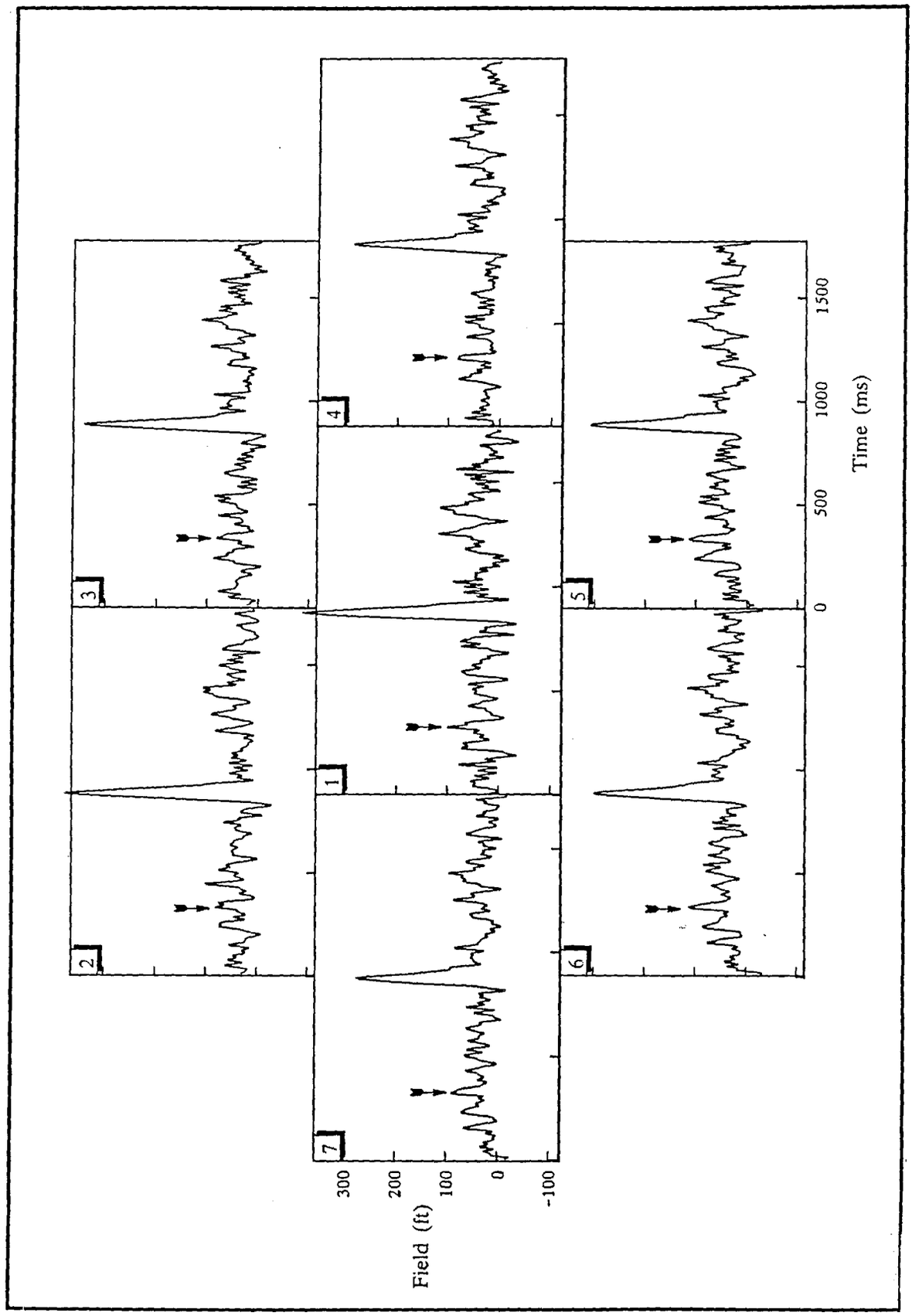

FIGURE 3 (U) VASSY PROTOCOL: 0 TO 1700 MS — V002, 8/22/88

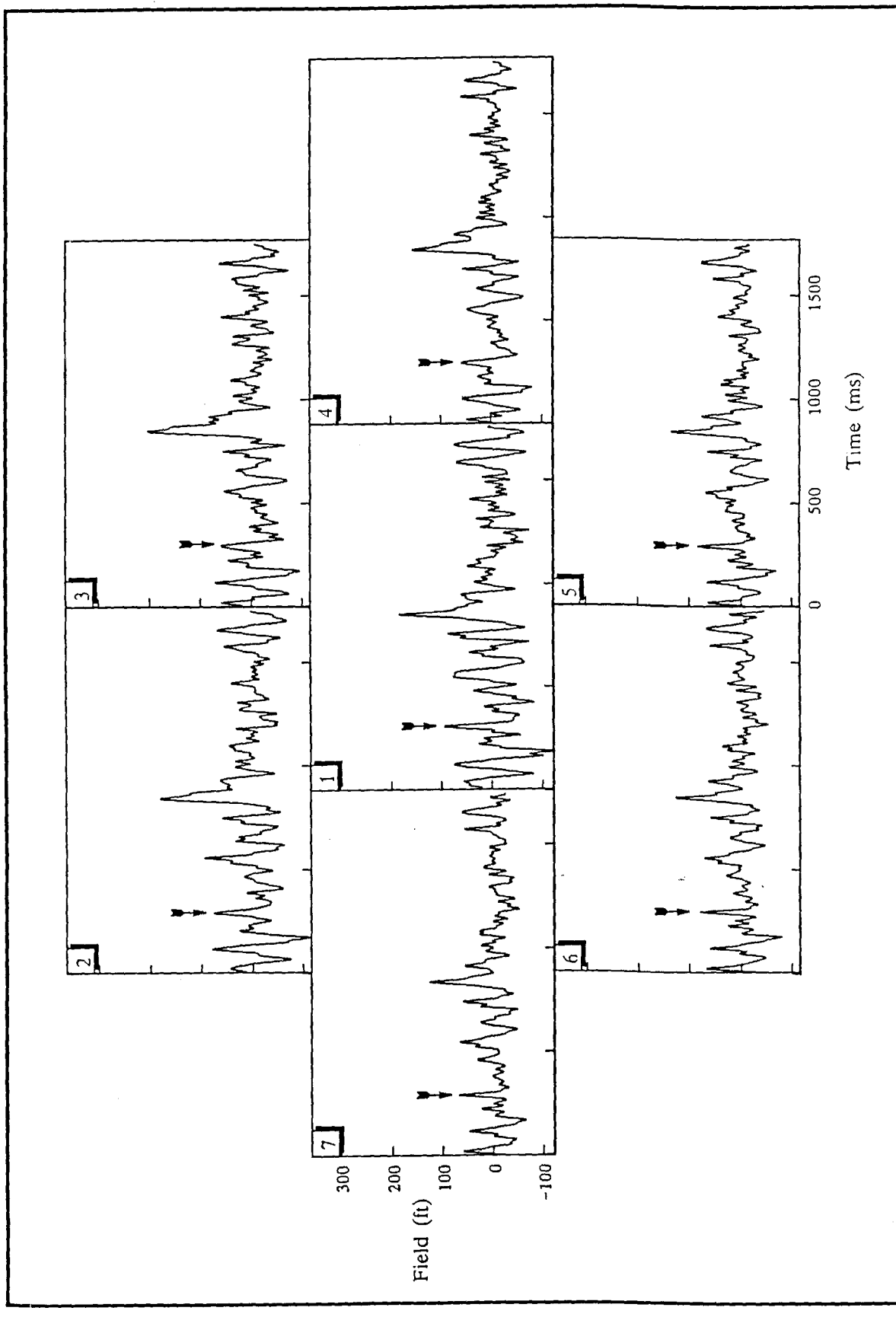

FIGURE 4 (U) VASSY PROTOCOL: 0 TO 1700 MS – V002, 8/23/88

amplitude of the peak is greater than its earlier amplitude; and in channel 1, its amplitude approaches one-half of the response to the direct stimulus.

(U) Figure 5 shows MEG data from one run and one detector for all participants in the Vassy protocol. Since the baseline recording period varied among viewers in length (designated "Long" and "Short" in Figure 5), the data, displayed at 5-ms intervals, are shown with the onset of the remote stimulus as a common point.

The peak labeled "ERF—RS" can be seen in data from all participants. The mean time of the peak (one detector per run) identified in the Vassy protocol is 98.2 ± 7.1 ms (three data channels) after the onset of the remote stimulus.

Figure 6 shows averages across viewers for long, short, and both ("All") timings. They are normalized by the individual run with the largest spread in magnetic field.

V009 participated in four separate runs: One in the psi protocol and three in the Vassy protocol. The candidate peak across all four runs has a mean of 102.25 ± 1.70 ms. No peaks are observed in the baseline period for four runs with similar timing constraints.

Several peaks in the remote stimulus (RS) poststimulus region appear to be present for all viewers; however, the candidate peak is the first one after the remote stimulus.

Some peaks shown in Figure 5 are responses to high-frequency (6-cpd) stimulus, and others are responses to a low-frequency (2-cpd) stimulus. No participant responded to both frequency stimuli.

The two protocols under consideration (Vassy and psi) are identical in one respect: They both contain a remote stimulus, and a putative response to that stimulus is sought. Therefore, one might expect a candidate peak identified in the Vassy protocol should be observed in the psi protocol as well. We have indicated that this is the case for V009 (this is discussed further in Section III.C).

While the averages shown in Figure 6 appear to provide evidence for a strong response to the remote stimulus, we must recognize that the data shown in Figure 5 could be examples of fortuitous peak selection. If so, then the averages shown in Figure 6 are the *expected* result.

Given the caveat about the approach, at least one candidate peak for a response to the remote stimulus appears to have been identified. More analysis and/or research is needed before a definitive statement can be made.

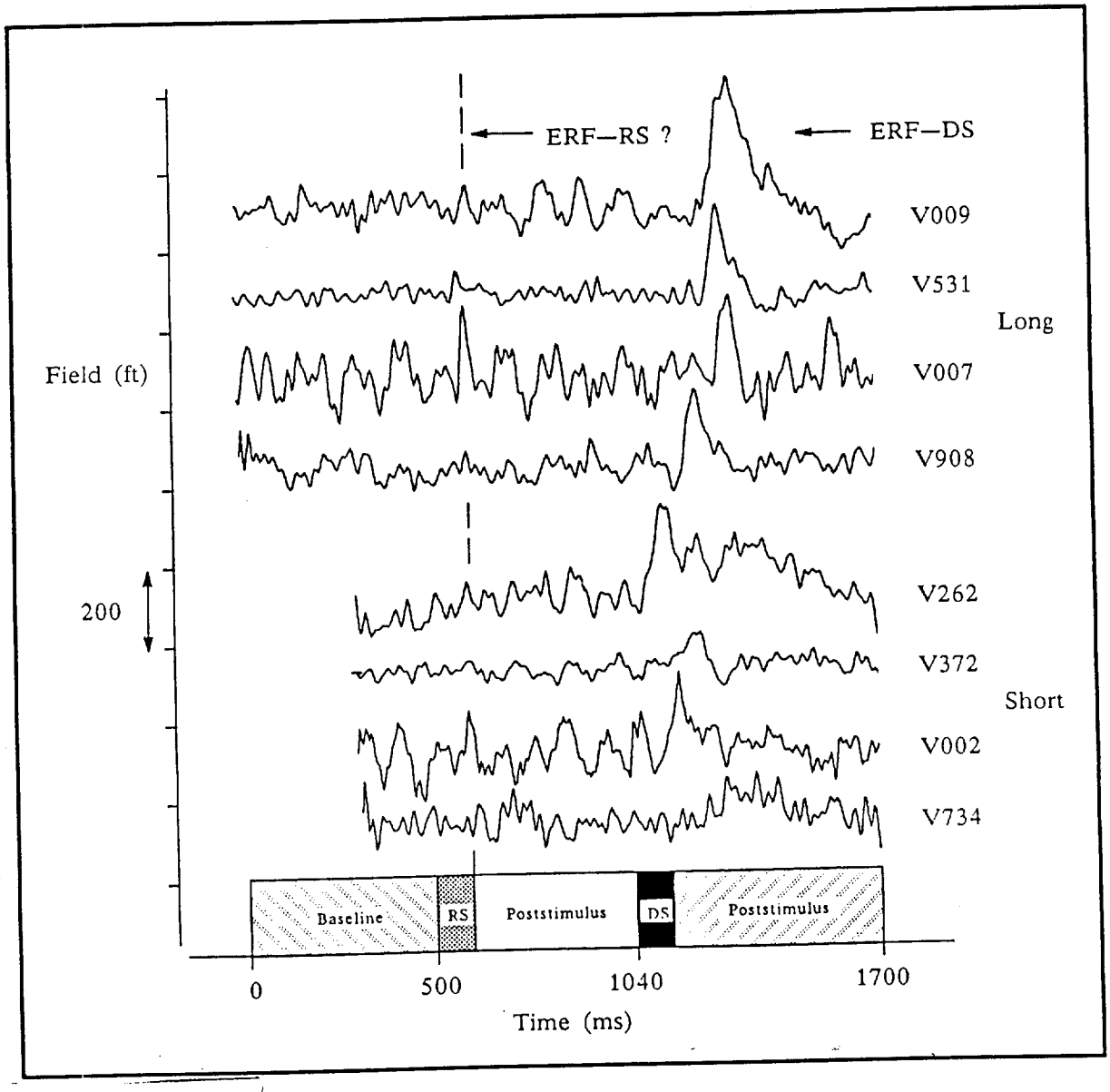

FIGURE 5 (U) VASSY PROTOCOL—50—TRIAL AVERAGES FOR EACH VIEWER

Should this peak be a response to a remote stimulus, then at least one alternative (to the psychoenergetic interpretation) must be considered. Since the shielded room for the MEG is nearly transparent at frequencies above 100 Hz, the observed peak might result from a CNS response to an electromagnetic signal related to the display of the stimuli on a standard television monitor.

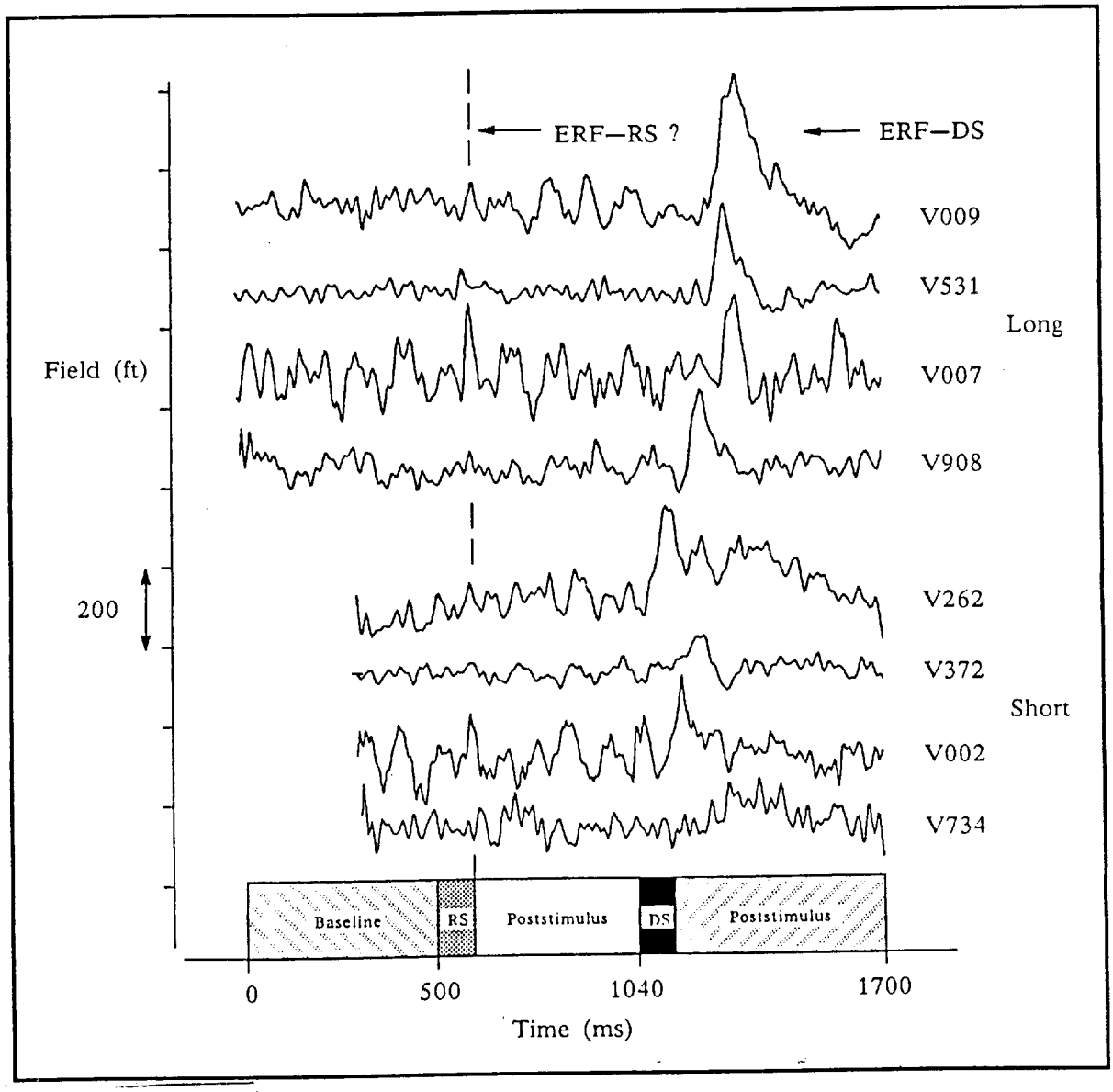

FIGURE 5 (U) VASSY PROTOCOL—50—TRIAL AVERAGES FOR EACH VIEWER

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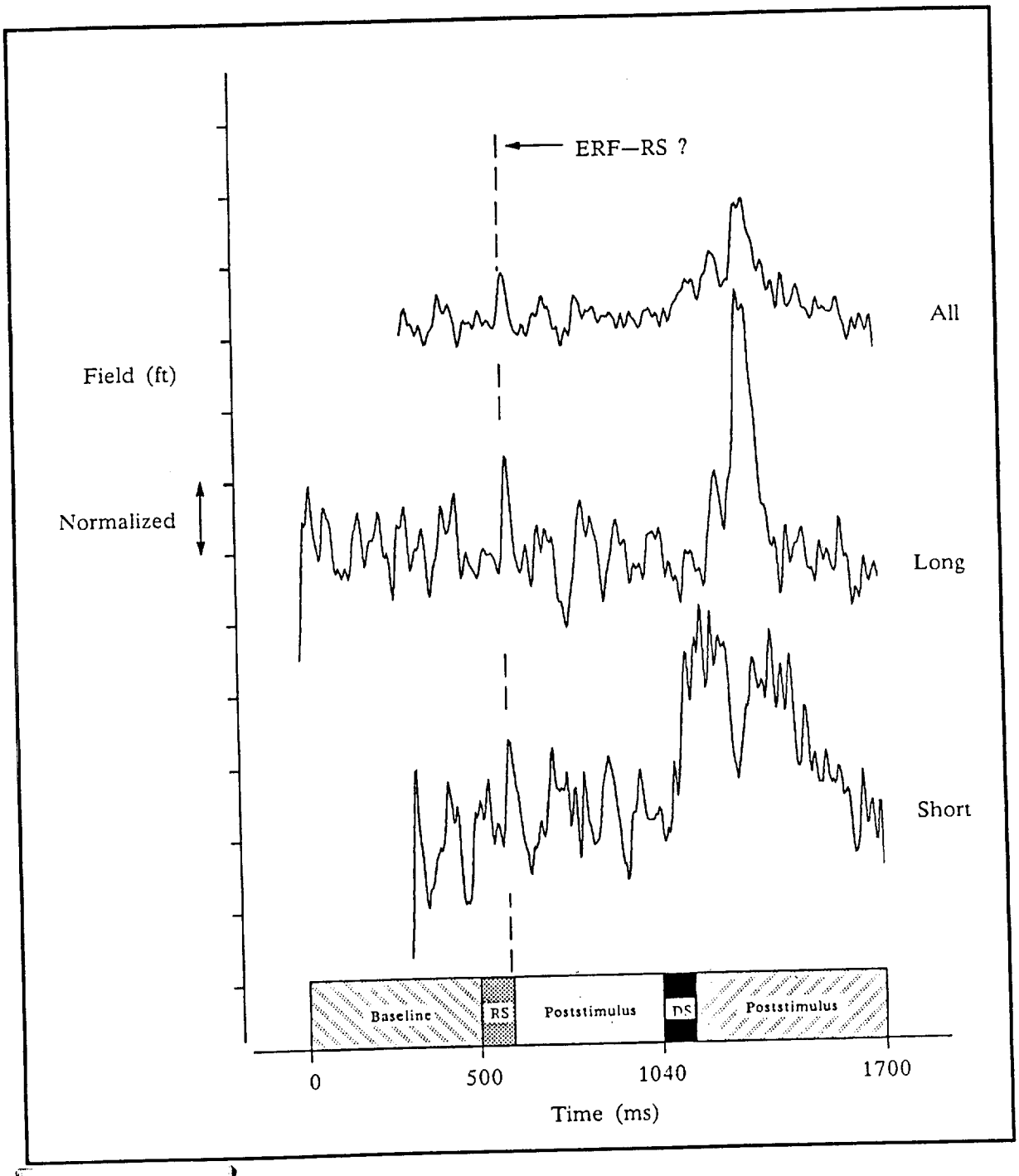


FIGURE 6 (U) VASSY PROTOCOL—AVERAGES

B. (U) Psi Protocol Results

(U) Viewers 002, 009, and 372 participated in the psi protocol experiment. Seven channels of MEG data, one channel of stimuli data, and one channel of button-response data were stored for each run of 120 seconds for later analysis. A series consisted of 10 such runs.

(U)
The complete protocol (described in Section II) was used for V002 and V372. Since V009 was the first viewer to participate and the experiment was mostly exploratory, no pseudostimuli were present, nor were postsession control runs conducted.

1. (U) Viewer 002

Viewer 002 visited Los Alamos National Laboratory from 22–26 August 1988. During that time V002 participated in three separate series in the psi protocol experiment. Figures 7 and 8 show the time series and power spectra, respectively, for the average of 118 pre- and poststimuli for all channels on 25 August. These data were chosen for display because this series was the first using the complete psi protocol. For the remote stimuli (Figure 7), channels 1, 4, and 7 show a qualitative change of activity in the time series across the stimulus boundary. All channels show a decrease of power in the prominent 10-Hz peak (Figure 8). Figures 9 and 10 show the same data for 74 pseudostimuli.

(U) To determine if the qualitative changes are exceptional, we analyzed the data by the Monte Carlo procedure outlined in Section II. We simulated the remote stimuli by generating 2000 sets of 118 Monte Carlo stimuli having the same timing as the original data. For each set, the data were averaged, detrended, and filtered, and the 10-Hz and total power were calculated for the pre- and poststimulus periods. The ratio of pre- to poststimulus power was also calculated, as were p-values (defined as the ratio of the area equal to or greater than the specified value, divided by the total area under the histogram).

(U) Figure 11 shows the resulting histograms of the 2000 sets for the 10-Hz peak in channel 4 (Figure 8); the ratio histogram is not shown. While separate histograms were generated for 74 pseudostimuli, for convenience the results shown on the histograms are for the remote stimuli—the histograms are nearly identical. The p-values shown, however, are derived from their appropriate histograms.

For this case (channel 4), the prestimulus 10-Hz power is not exceptional ($p \leq 0.093$) when compared with the rest of the data in this series. The postsession 10-Hz power is exceptionally small—94.4% of the 2000 Monte Carlo cases produce 10-Hz power larger than the observed value. The ratio of pre- to poststimulus 10-Hz power is significant ($p \leq 0.093$). In other words, the change in 10-Hz power across the stimulus boundary primarily results from a large drop (relative to the rest of the data) in power just after the stimulus.

Significant changes in 10-Hz power are also observed in channel 7 ($p \leq 0.038$), while no significant changes are observed for the pseudostimuli. Channels 4 and 7

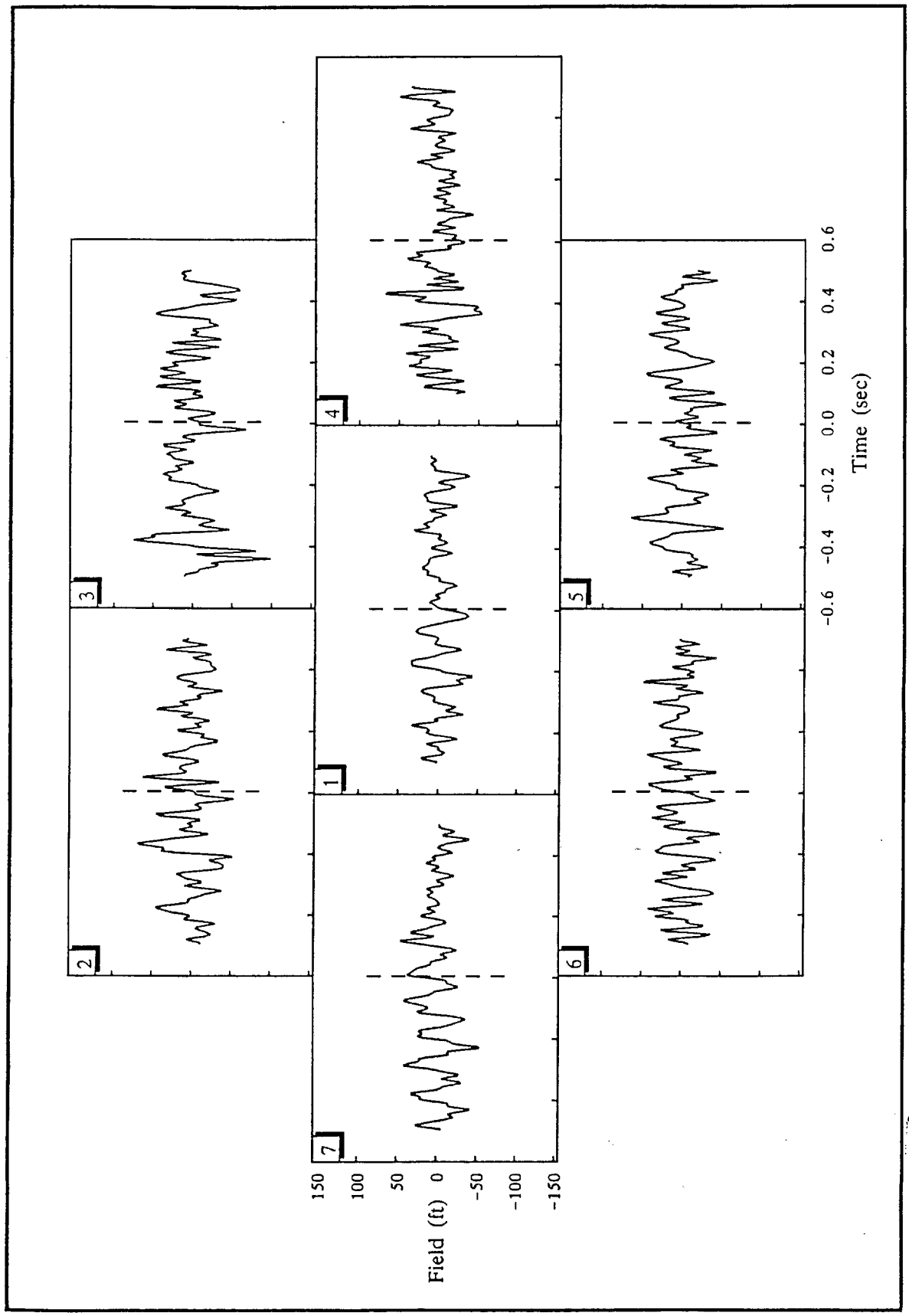


FIGURE 7 (U) TIME SERIES: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI – V002, 8/25/88

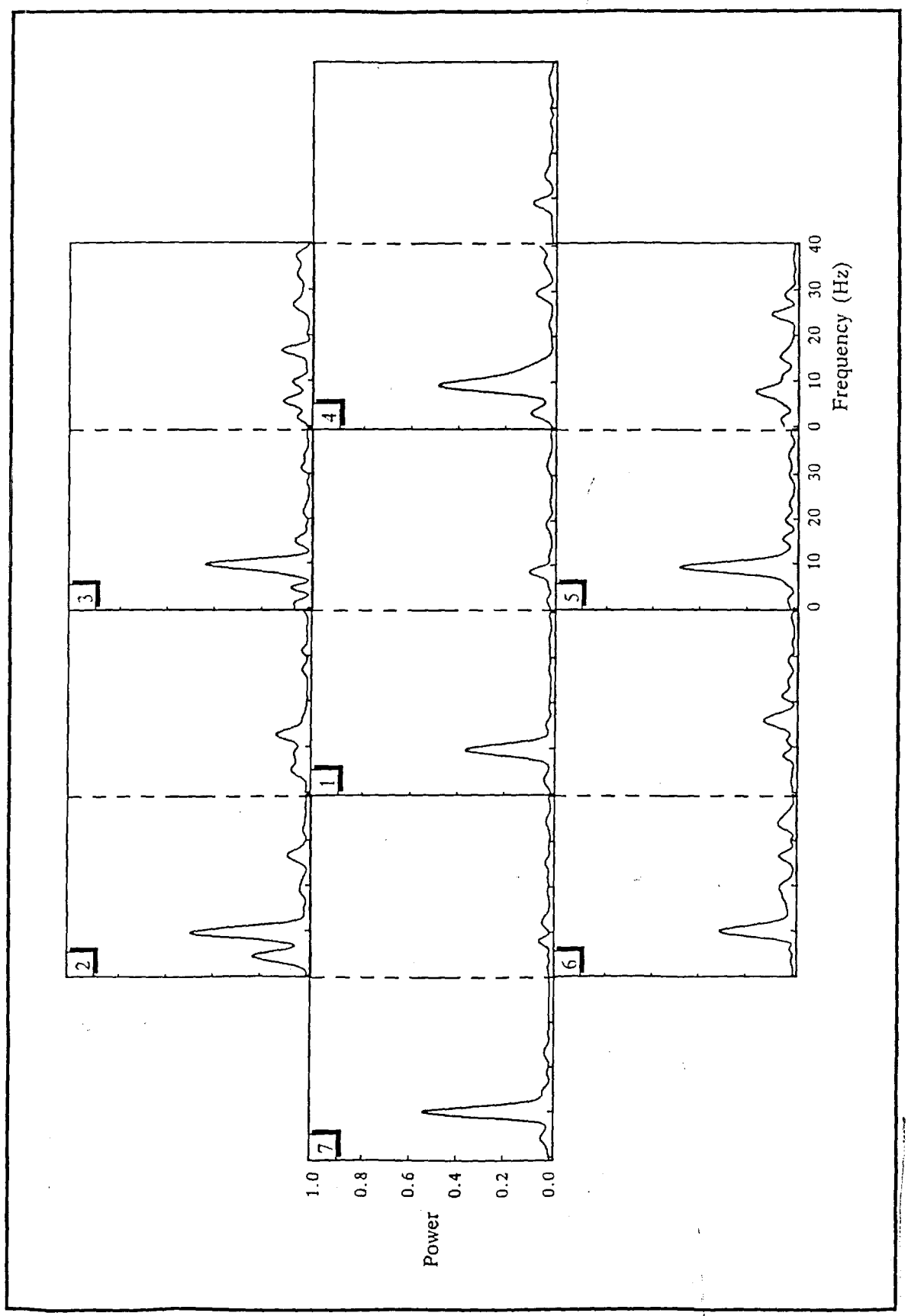
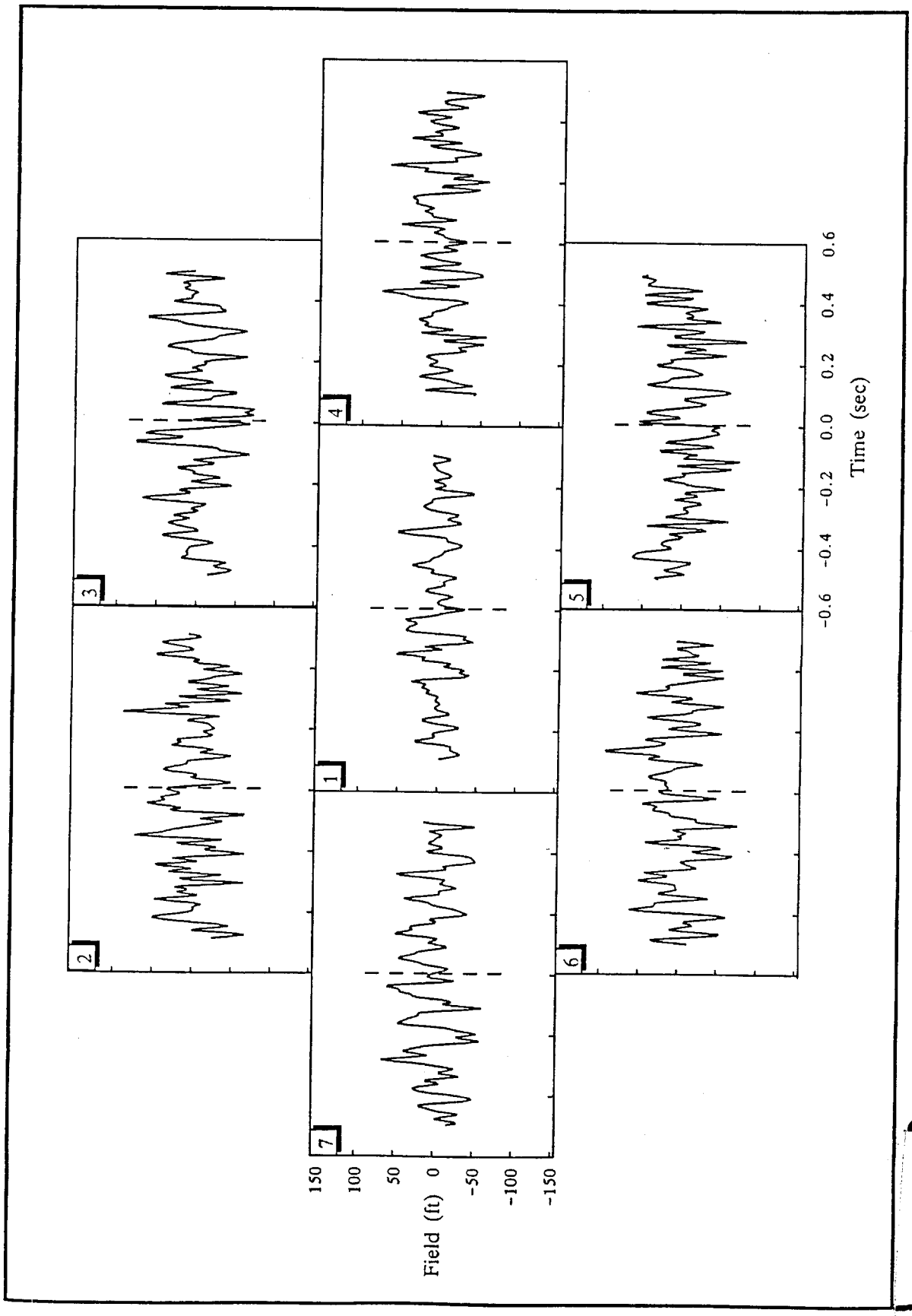


FIGURE 8 (U) POWER SPECTRA: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI – V002, 8/25/88



URE 9 (U) TIME SERIES: -0.5 TO +0.5 SECONDS FROM PSEUDO STIMULI — V002, 8/25/88

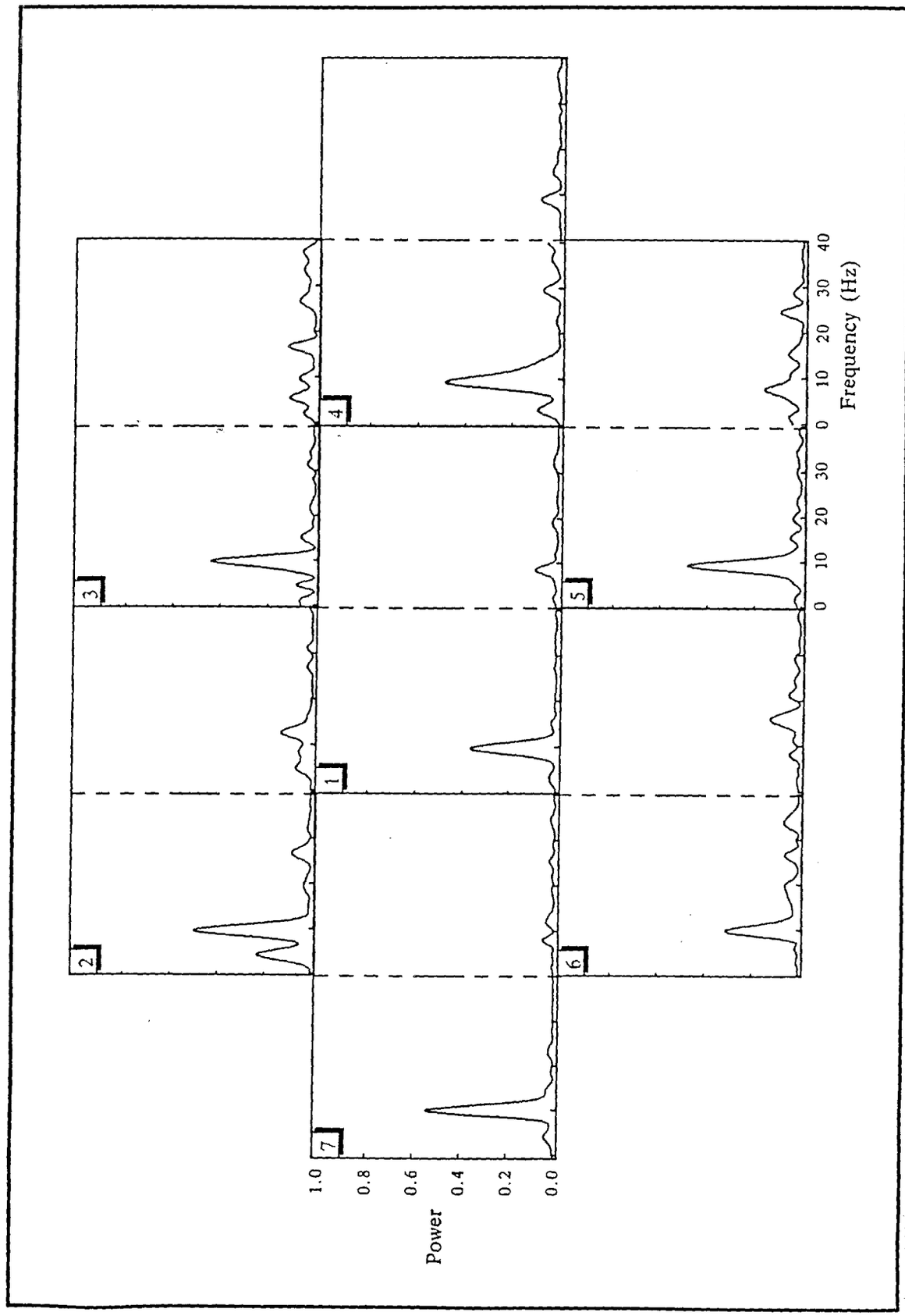


FIGURE 8 (U) POWER SPECTRA: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI — V002, 8/25/88

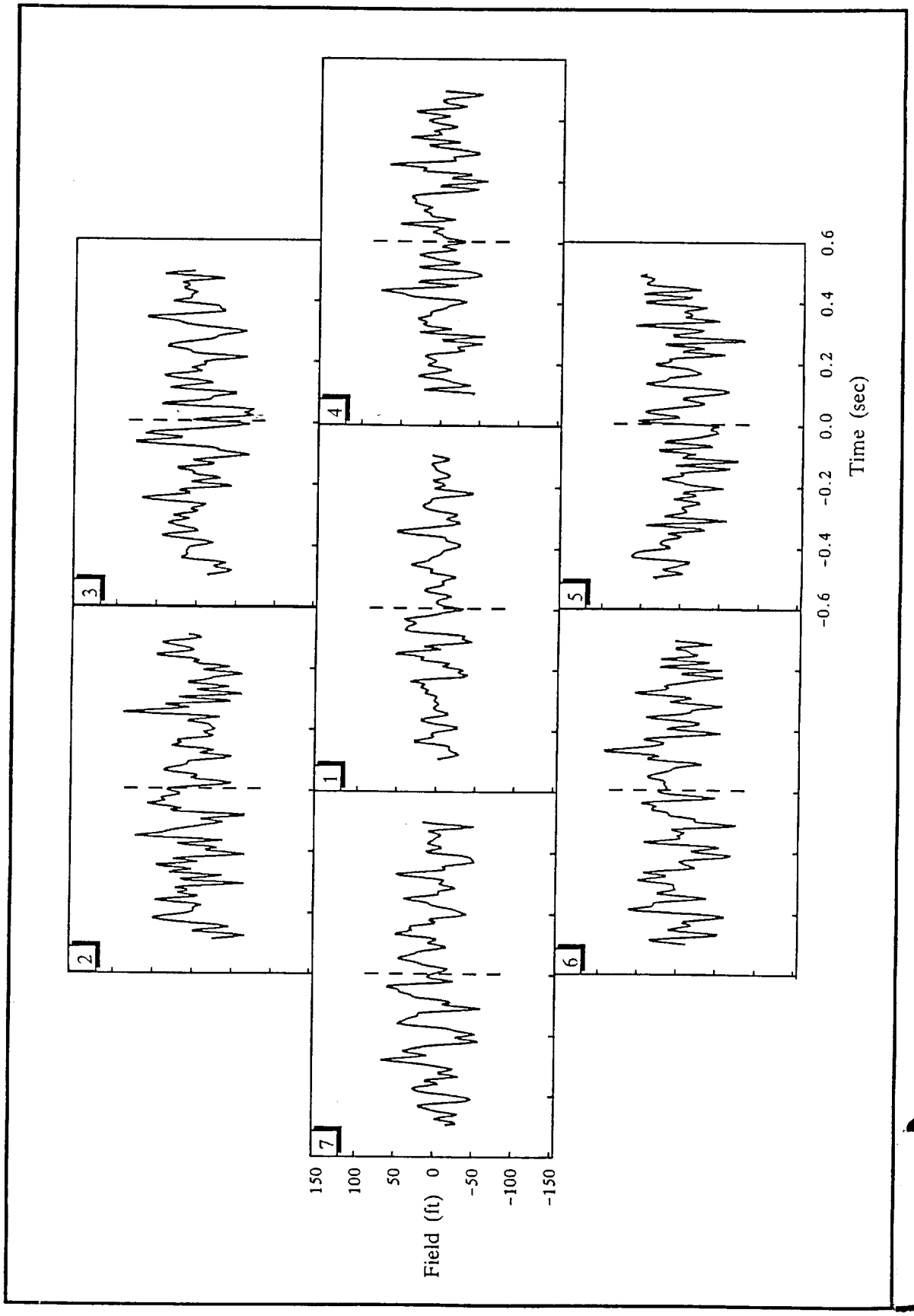


FIGURE 9 (U) TIME SERIES: -0.5 TO +0.5 SECONDS FROM PSEUDO STIMULI — V002, 8/25/88

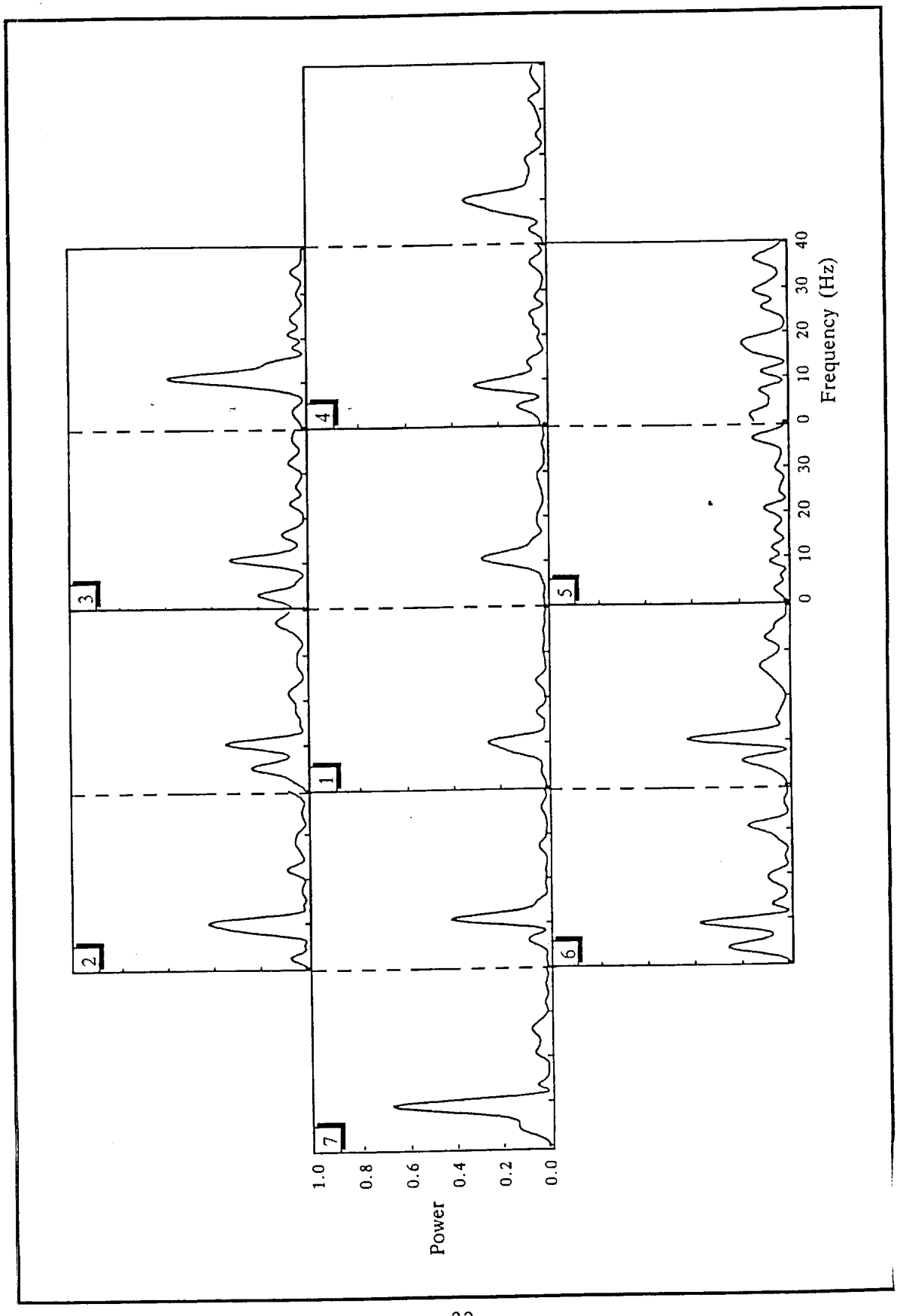


FIGURE 10 (U) POWER SPECTRA: -0.5 TO +0.5 SECONDS FROM PSEUDO STIMULI — V002, 8/25/88

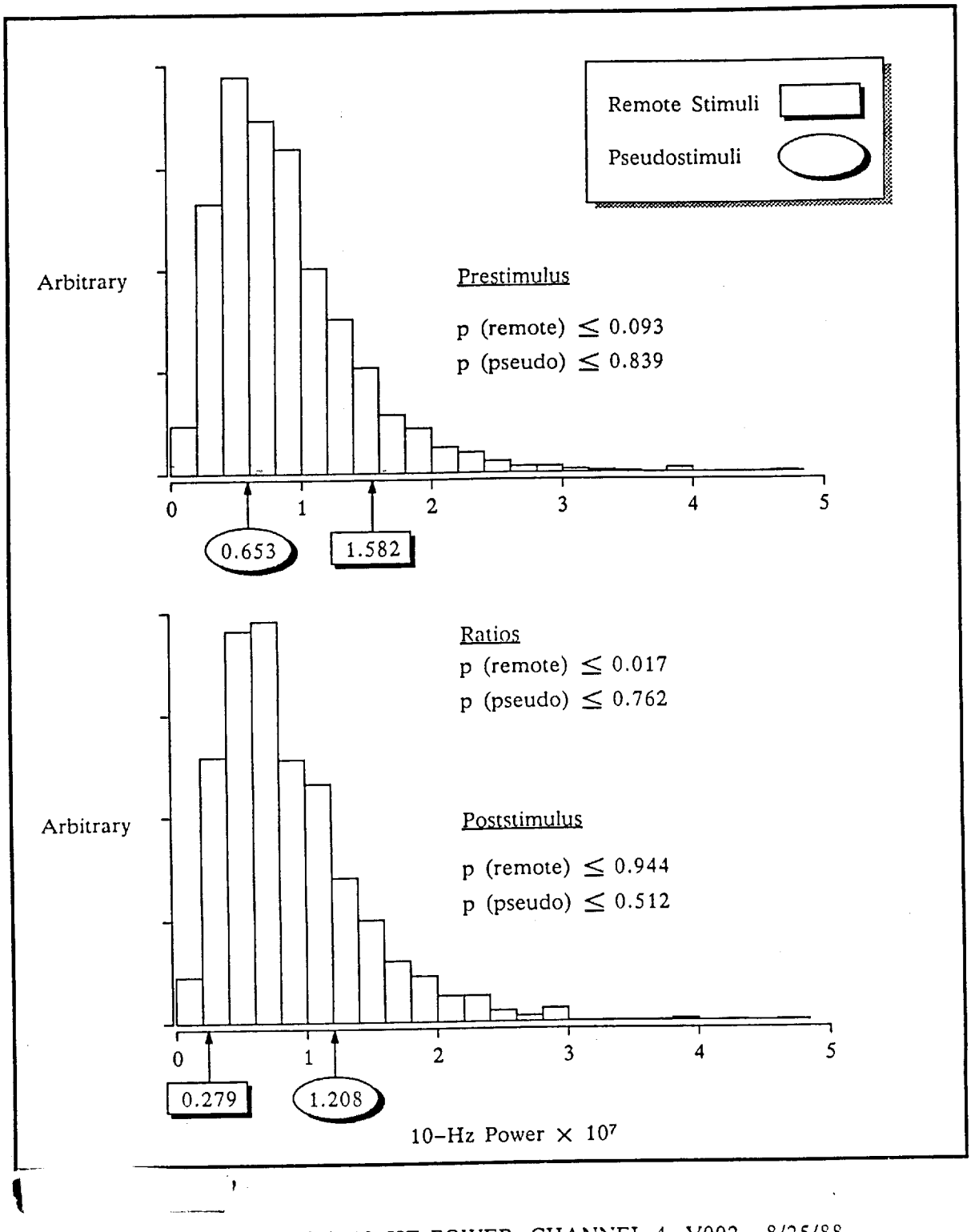


FIGURE 11 (U) 10-HZ POWER: CHANNEL 4—V002, 8/25/88

show significant decreases in total 0– to 40–Hz power ($p \leq 0.002$, 0.033, respectively), but no pseudostimuli show significant changes.

A postsession background series was conducted with both sender and viewer absent from the experimental area (see Section II.B). Figures 12 and 13 show the time series and power spectra, respectively, for the background "remote" stimuli. As can be seen from the power spectra (all data for this day are plotted on the same vertical scale), overall power is sharply reduced, reflecting that the MEG was not observing any CNS activity. Qualitatively, the changes shown for the experimental conditions (remote stimuli) do not result from noise in the MEG hardware.

These qualitative results are confirmed by the Monte Carlo analysis. The p–values for the changes in 10–Hz and total power for channel 4 are 0.406, and 0.141, respectively; for channel 7, the p–values are 0.993 and 0.243, respectively. The significant change in 10–Hz power in channel 7 is in the opposite direction from that observed under experimental conditions.

During the series on 25 August 1988, V002 kept his eyes closed throughout the session. On 26 August, V002 was instructed to keep his eyes open. Similarly to the analysis of the 25 August series, the Monte Carlo analysis shows a sharp decrease in 10–Hz power ($p \leq 0.100$) and a significant decrease in total power ($p \leq 0.049$) for the CNS activity detected in channel 4. No significant changes are observed for channel 7, nor are significant changes seen in the pseudostimuli. The change from 25 to 26 August might result from a slight change in positioning of the detector array.

Figure 14 shows the positions of the detector array, relative to the inion, for V002 for the 25 and 26 August placement of the detector arrays. The magnitude of change in detector placement is approximately twice the magnitude of the changes used in searching for the response to direct stimulus during initial calibration. This relatively large position change could account for the reduction in changes across the stimulus boundary.

2. (U) Viewer 009

Viewer 009 visited Los Alamos National Laboratory from 20–24 June 1988. During that time, V009 participated in one psi series on 24 June 1988. Figure 15 shows the time series data averaged over 97 trials, displayed –0.5 to +0.5 seconds from the remote stimulus. Figure 16 shows the power spectra for the 0.5–second pre– and poststimulus times for all channels.

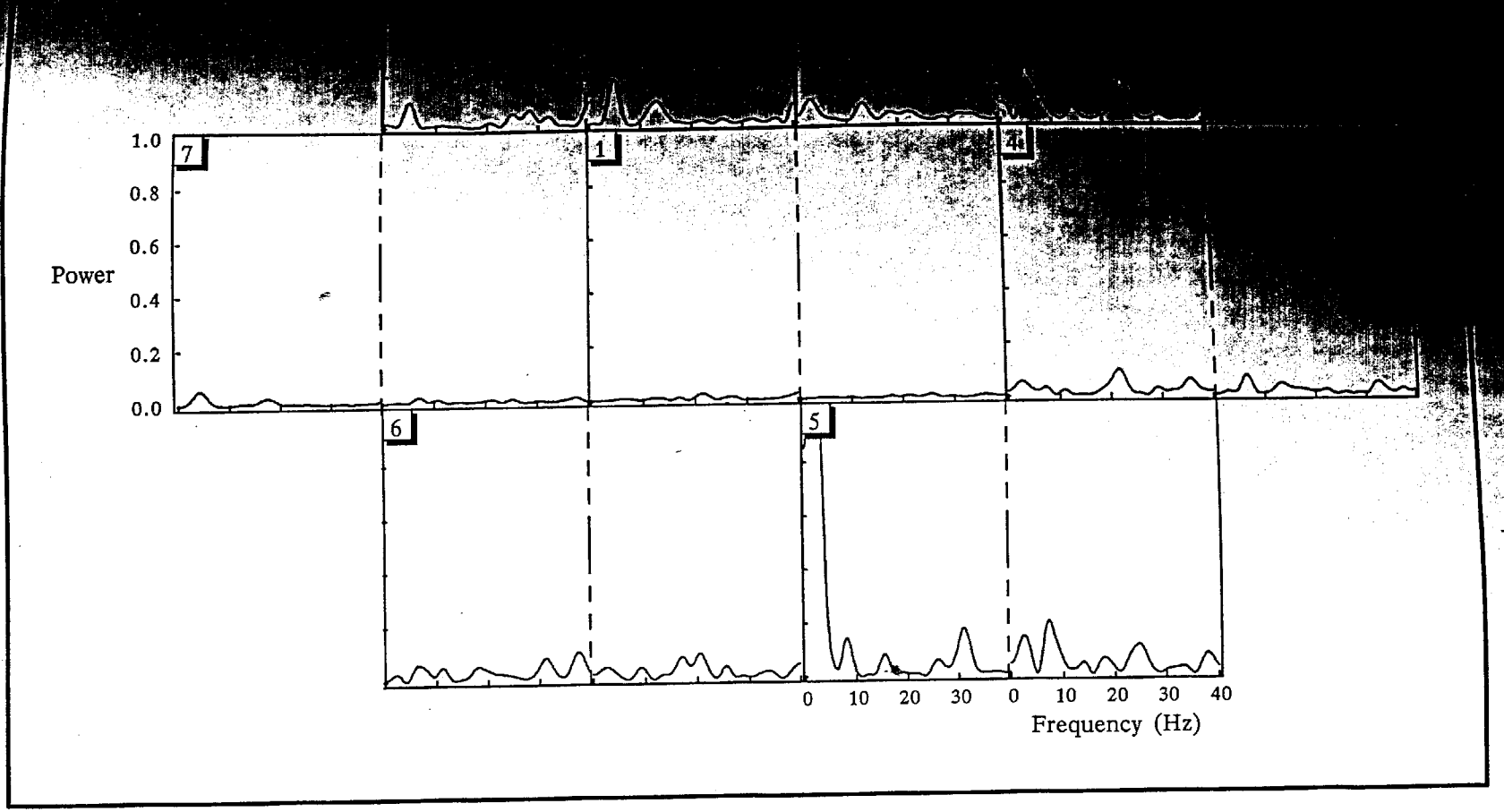


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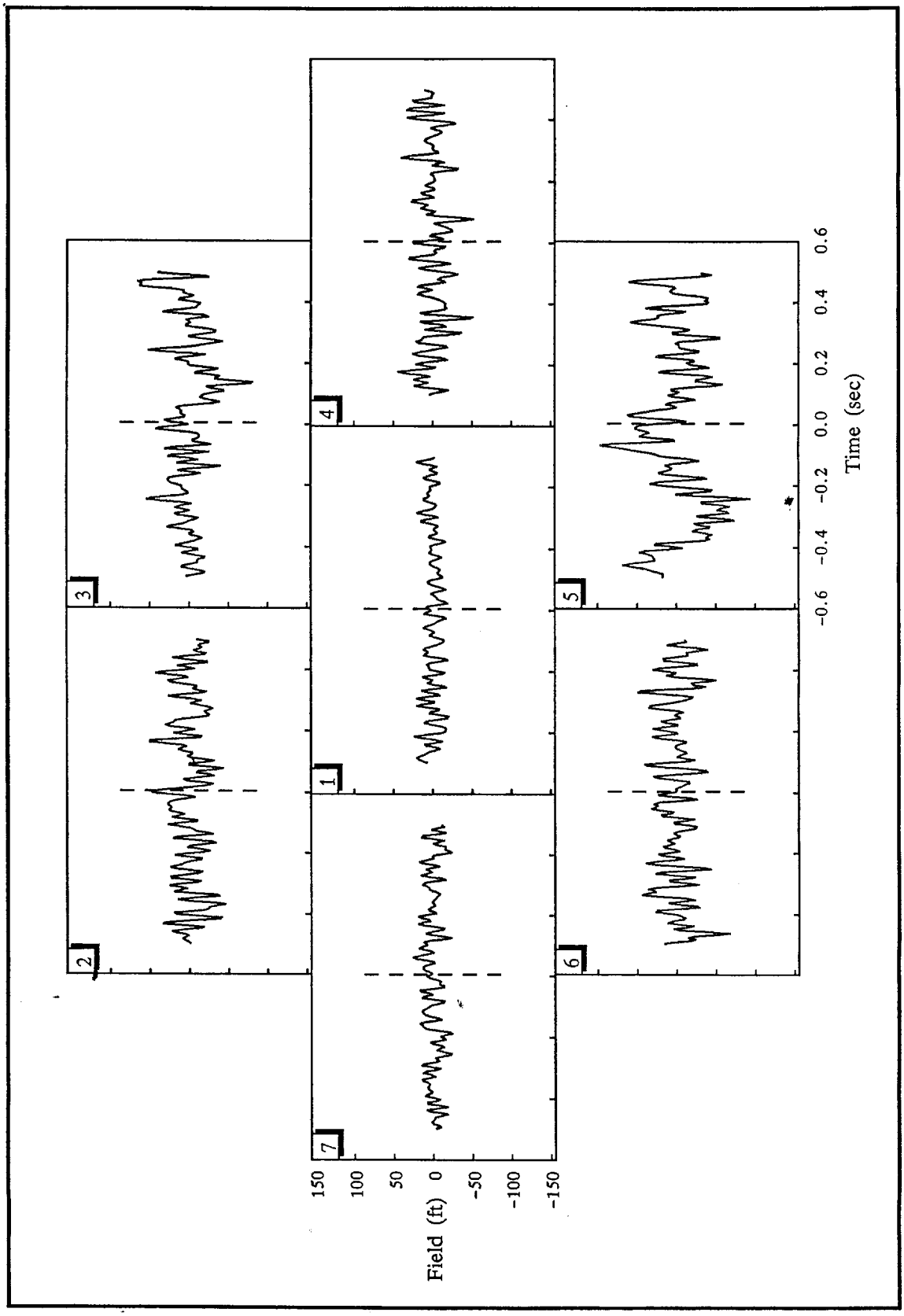
FIGURE 13 (U) POWER SPECTRA: -0.5 TO +0.5 SECONDS FROM "REMOTE" STIMULI POSTSESSION BACKGROUND — V002, 8/25/88



UNCLASSIFIED

FIGURE 12 (U) TIME SERIES: −0.5 TO +0.5 SECONDS FROM "REMOTE" STIMULI
POSTSESSION BACKGROUND — V002, 8/25/88

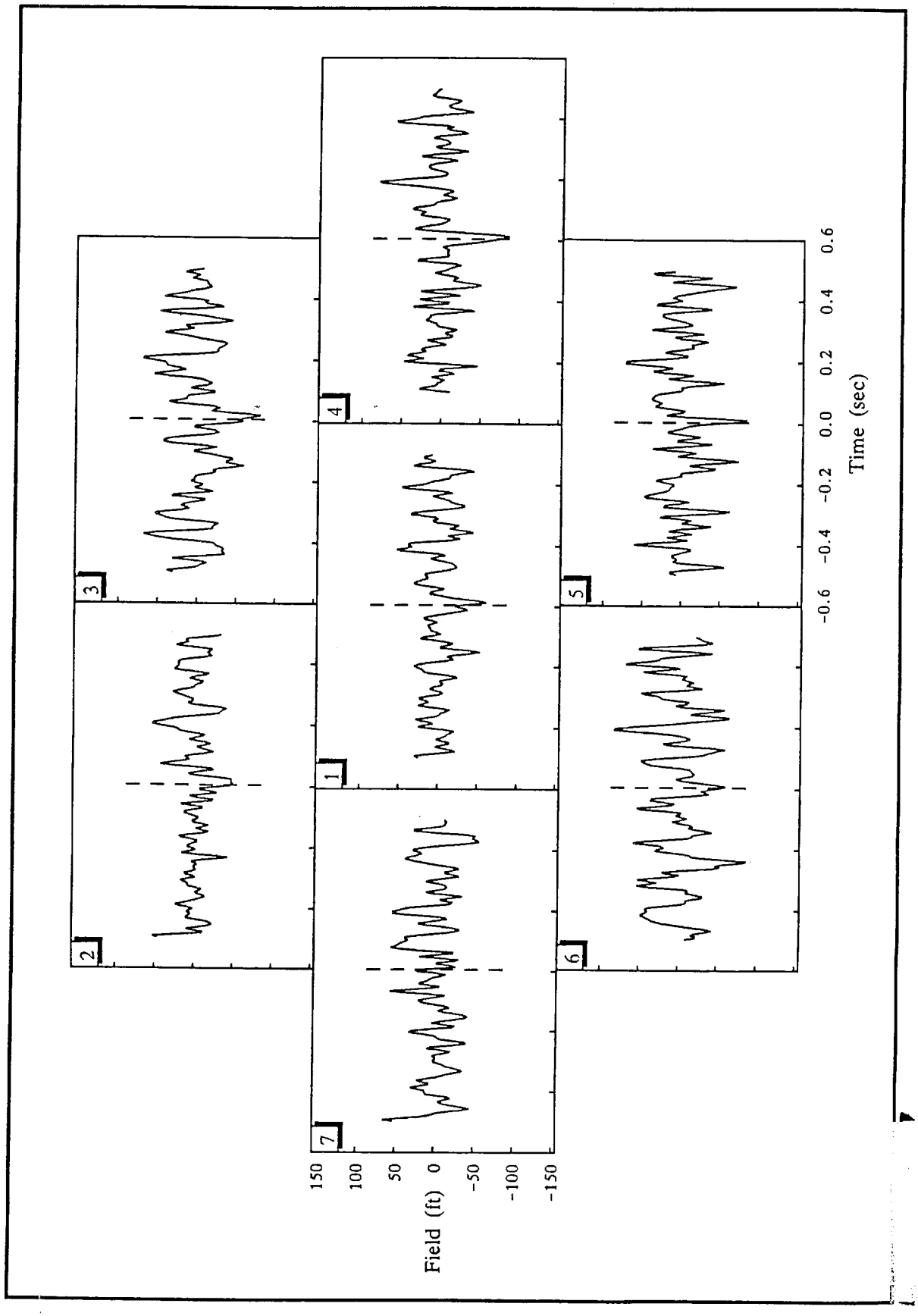


FIGURE 15 (U) TIME SERIES: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI — V009, 6/24/88

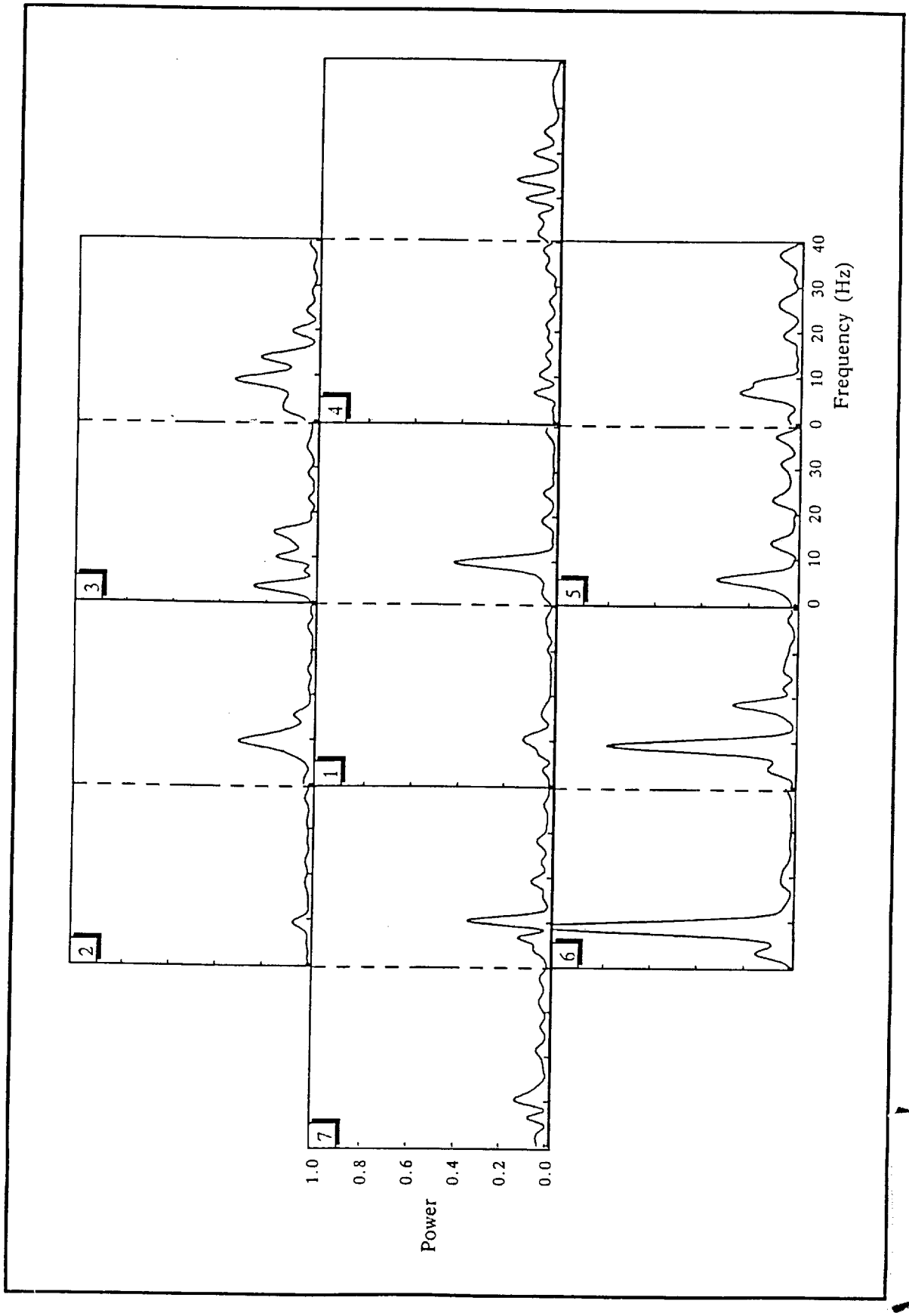


FIGURE 16 (U) POWER SPECTRA: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI — V009, 6/24/88

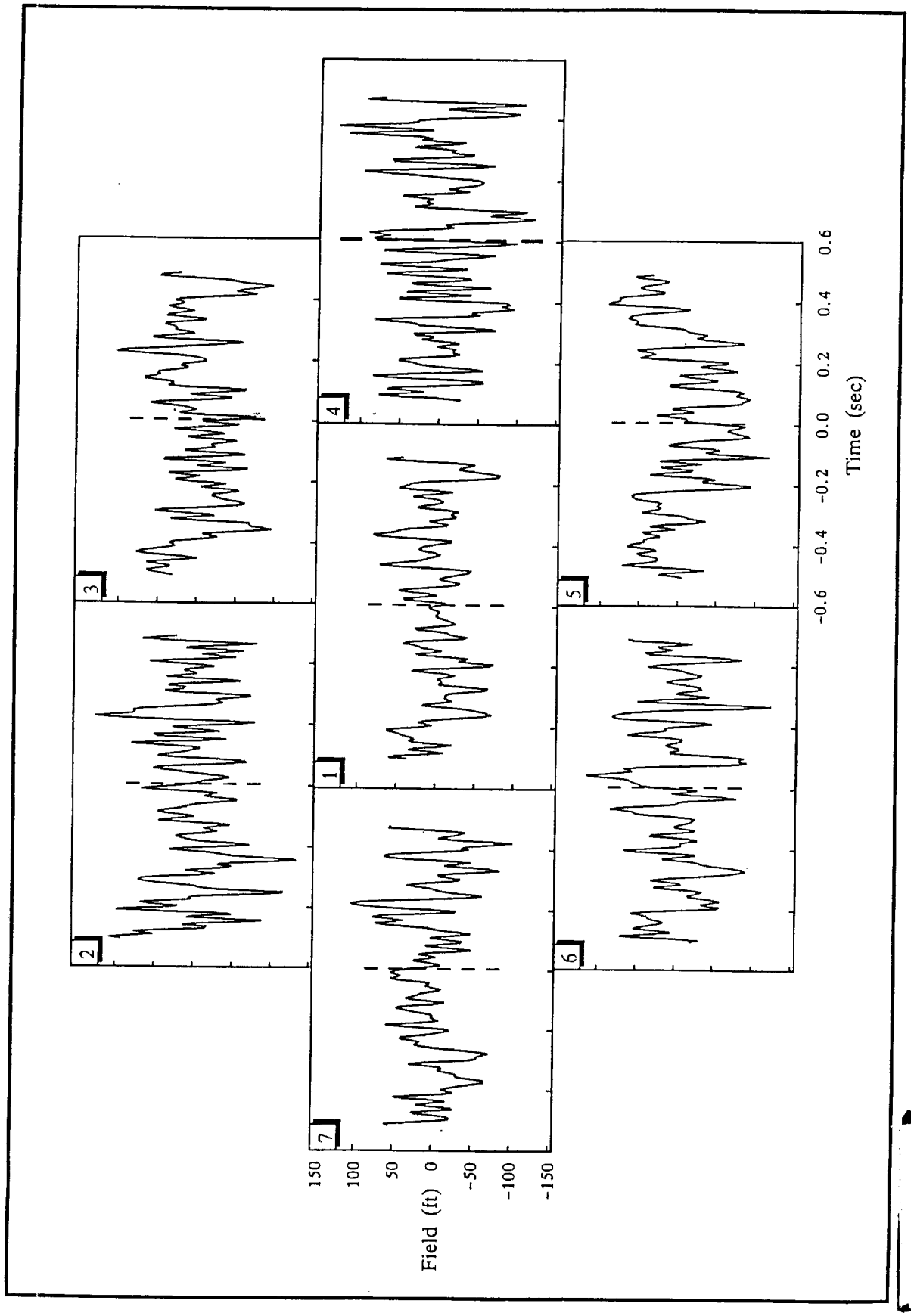


FIGURE 17 (U) TIME SERIES: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI – V372, 10/19/88

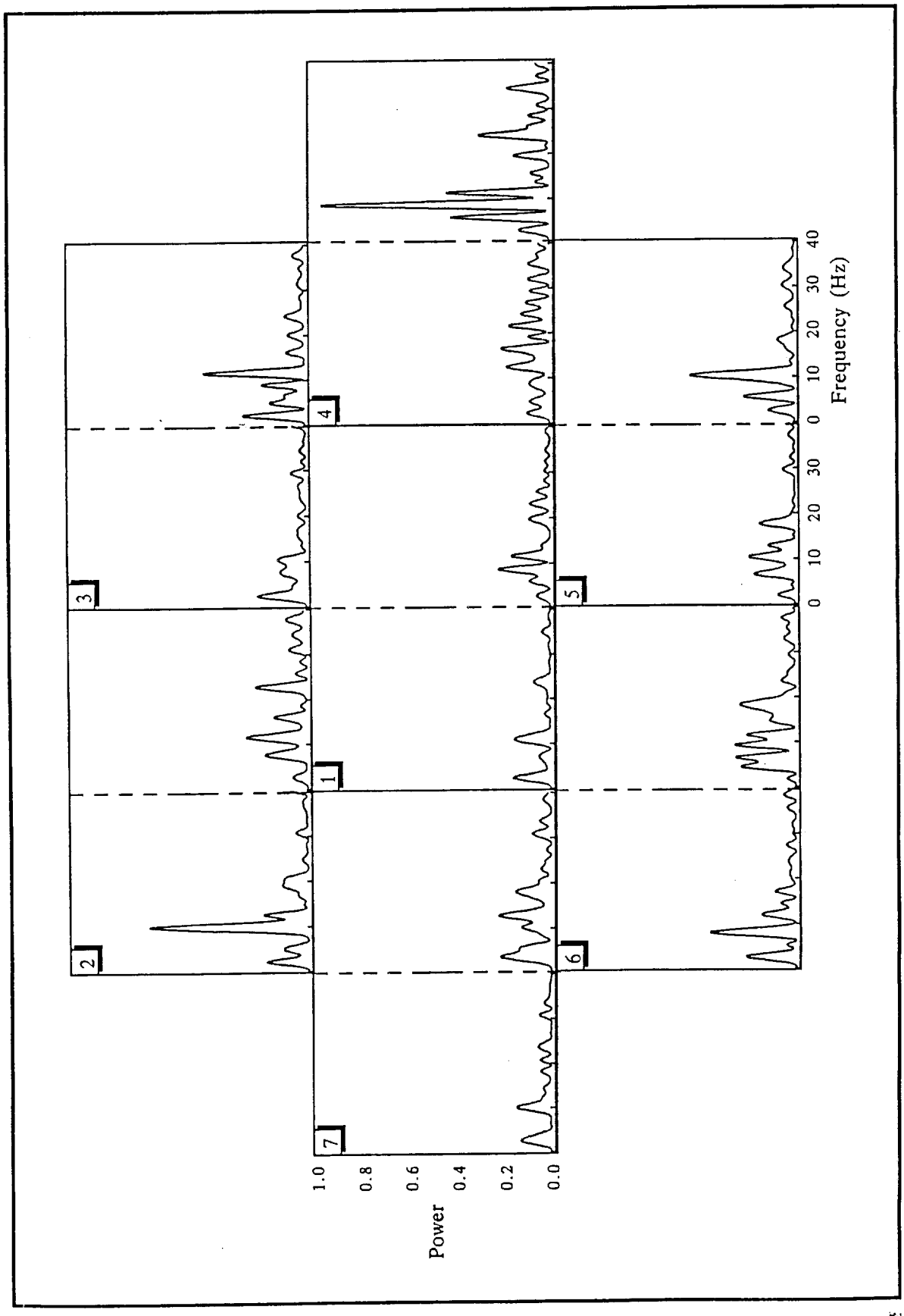


FIGURE 18 (U) POWER SPECTRA: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI — V372, 10/19/88

Using the Monte Carlo technique we find channel 4 shows a significant increase in 10-Hz power ($p \leq 0.038$), and channels 3 and 5 show similar trends. The strong peak at 8.9 Hz in channel 4 is significantly larger in the poststimulus condition.

Figures 19 and 20 show the time series and power spectra for the pseudostimuli. The 10-Hz and total power in channel 4 show no change across the stimulus boundary ($p \leq 0.667$ and $p \leq 0.506$, respectively). Channel 3 also shows no significant changes in the 10-Hz and total power ($p \leq 0.140$ and $p \leq 0.180$, respectively). Channel 5, however, shows a significant increase in total power ($p \leq 0.026$), and a strong increase ($p \leq 0.082$) in 10-Hz power.

C. (U) Psi Protocol Results—Vassy Consideration

(U) Because the Vassy and psi protocol both present a remote stimulus to the viewer, the candidate peak seen in the Vassy protocol data should also be seen in the psi protocol data. One run on one channel is shown in Figure 21 for each participant in the psi protocol experiment.

V009's data show a candidate peak within ±2 ms of the candidate peak identified under the Vassy protocol. Similarly, small peaks are seen for the other two viewers. The cross-viewer normalized average is also shown in Figure 21.

D. (U) Psi Protocol Results—Button-Press

(U) In the early SRI studies significant changes in alpha production were observed in response to a remote stimulus. The statistical evidence, however, did not indicate that the viewer was able to recognize a remote stimulus cognitively (i.e., the viewer's button presses did not exceed mean chance expectation).

(U) In the psi protocol of the current experiment, viewers are asked to press a button whenever they think a remote stimulus occurs. The total number of trials during a series of 10 runs is not known in advance because of the trial randomization procedures. To determine if a viewer is cognitively sensing the remote stimuli, the null hypothesis that the probability of a time interval having a stimulus is the same for those intervals with a button press as for those without a button press. In other words, the presence or absence of a stimulus is independent of the presence or absence of a button press.

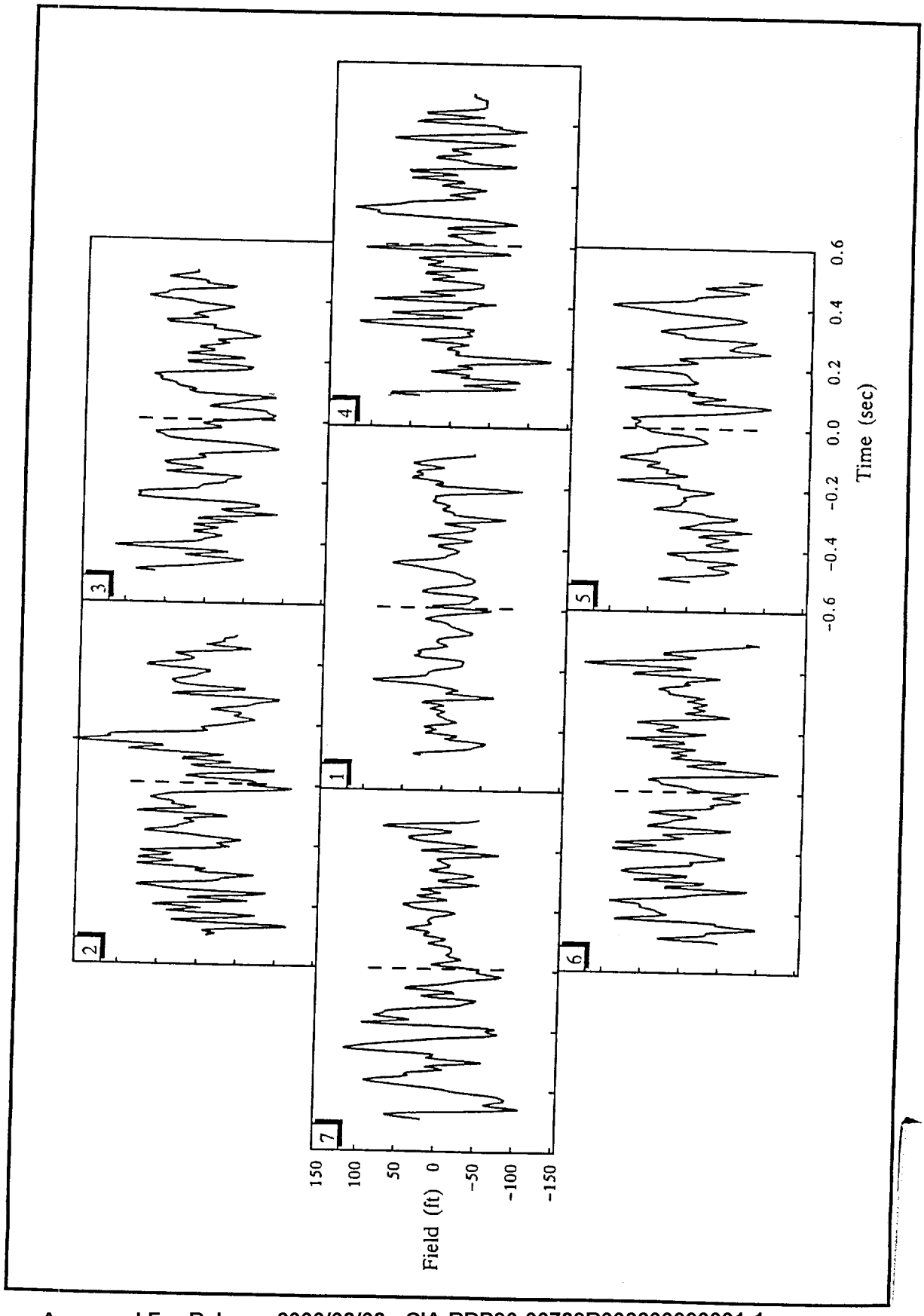


FIGURE 19 (U) TIME SERIES: -0.5 TO +0.5 SECONDS FROM PSEUDO STIMULI — V372, 10/19/88

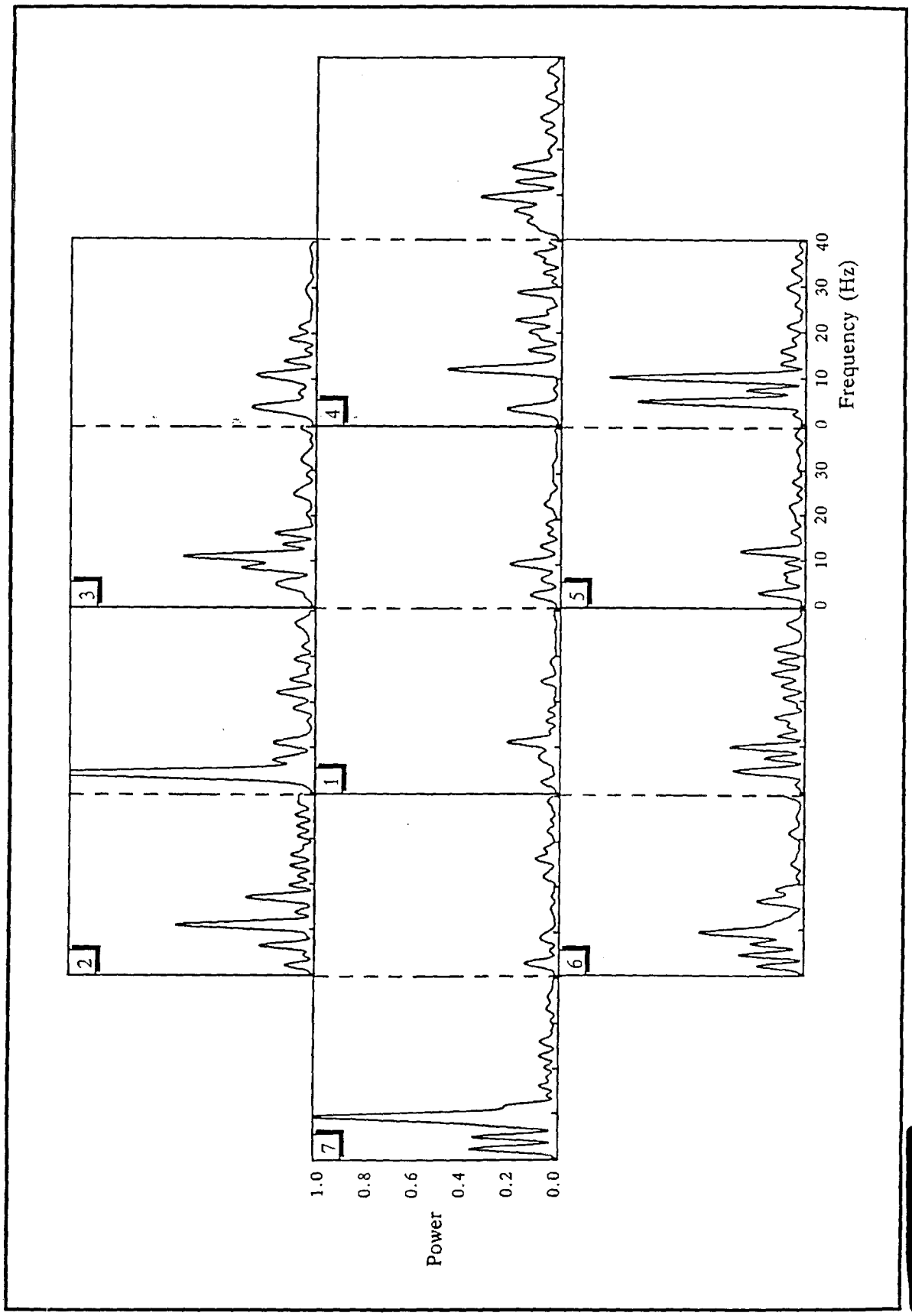


FIGURE 20 (U) POWER SPECTRA: -0.5 TO +0.5 SECONDS FROM REMOTE STIMULI – V372, 10/19/88

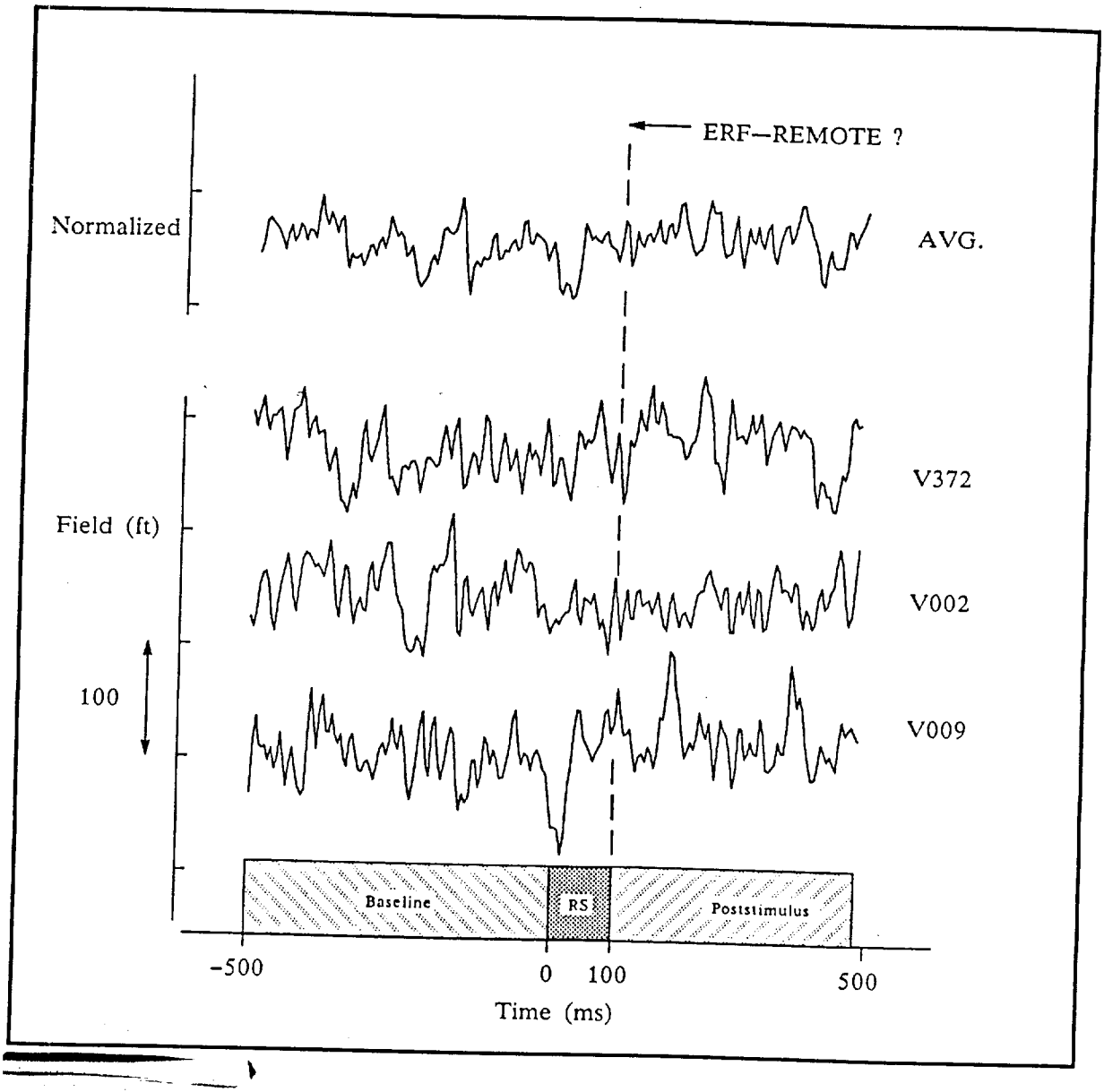


FIGURE 21 (U) VASSY PROTOCOL—AVERAGES FOR EACH VIEWER

(U) To test the hypothesis, the entire series is broken into 1-second intervals. Table 1 shows the format for data accumulated for one series.

Table 1

(U) DATA FORMAT

		Stimulus	
		Yes	No
Response	Yes	A	B
	No	C	D

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(U) The fractional hitting rate is $p_1 = A/(A+B)$, and the fractional missing rate is $p_2 = C/(C+D)$. The total number of 1-second intervals is $N = (A+B+C+D)$, and the total stimulus rate is $p_0 = (A+C)/N$. Then the following statistic is approximately normally distributed with a mean of 0 and a variance of 1 under the null hypothesis:

$$z = \frac{(p_1 - p_2)}{\sqrt{p_0(1-p_0)\left(\frac{1}{(A+B)} + \frac{1}{(C+D)}\right)}} .$$

Table 2 shows N, p_0, p_1, p_2, z, p-value, and the effect size, r, for the three psi protocol series for which button press data exist. As in the early SRI study, nothing indicates cognitive recognition of the remote stimuli.

Table 2

(U) BUTTON PRESSING RESULTS

Viewer	N	p_0	p_1	p_2	z	p	r
002	1210	0.167	0.198	0.164	0.951	0.163	0.027
009	1280	0.091	0.068	0.094	-0.978	0.836	-0.027
372	1089	0.157	0.119	0.160	-0.996	0.840	-0.030

IV DISCUSSION AND CONCLUSIONS (U)

We have observed two types of CNS activity possibly related to a response to a remote stimulus. The first of these (changes in alpha and/or total power) is generally considered to be less localized than an ERF to a direct stimulus. Thus, one expects that changes of power across a remote stimulus boundary should be seen in some related channels.

This is the case for V002 (Figure 8). While channels 4 and 7 show significant changes across the stimulus boundary, a qualitative trend is clear for all channels. The associated pseudostimuli show no obvious trends. Viewer 009 demonstrates significant changes in 10-Hz power in channel 2, and strong changes in channels 1 and 7 (Figure 16). The grouping of these channels might indicate a broad neuronal source in the channel-2 direction.

The data from V372 (Figure 18) are less clear. Alpha power changes significantly in channel 4, and a qualitative trend is clear in channels 3 and 5, but the trend is less obvious than for V002 or V009. V372 posed a special problem. Anatomically, his strongest response to a direct visual stimulus was located below the inion—a difficult location to reach with the MEG. To obtain good data, V372 was required to hunch his head forward by bracing his arms under his chest. During a long session (20 minutes), V372 could have relaxed slightly from this uncomfortable position and pulled away from the detector array. In this location, some detectors were positioned just above V372's neck.

Considering that all three viewers (002, 009, and 372) showed a change (increase or decrease) in total or 10-Hz power across a remote stimulus boundary, and considering that this constitutes a positive replication of SRI's earlier work, we probably observed a response to a remote stimulus.

The situation is much less clear concerning a localized response to a remote stimul While a candidate peak has been identified using the Vassy protocol and later observed using the psi protocol, a quantitative measure must be developed to determine the probability of observing peaks with similar timing in the same data but with random pseudostimuli.

(U) This work will be continued during the first half of FY 1989.

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